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AN
HISTORICAL ACCOUNT
OF
INVENTIONS AND DISCOVERIES
IN THOSE
ARTS AND SCIENCES,

WHICH ARE OF
UTILITY OR ORNAMENT TO MAN,

LEND ASSISTANCE TO HUMAN COMFORT, A POLISH TO LIFE, AND RENDER
THE CIVILIZED STATE, BEYOND COMPARISON, PREFERABLE
TO A STATE OF NATURE;

TRACED FROM THEIR ORIGIN;
WITH EVERY SUBSEQUENT IMPROVEMENT.

BY J. F. LAKE WILLIAMS.

IN TWO VOLUMES.

VOL. II.



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AN
HISTORICAL NARRATIVE
OF
INVENTIONS,
&c. &c.

NATURAL PHILOSOPHY—*continued.*

Component Parts of the Terrestrial Interior considered, with respect to Geometrical Form.—Anticipating the gratitude which the pious mind of *Diomed* must have felt, who prayed for light to meet his foes, on having his prayer granted,—we are grateful to thee, O Calliope! for having permitted us again to breathe the purer air of this upper world, and suffering us to behold the welcome orb of day. Our thanks are also due, for enabling us to discover a friend, experienced to direct the uncertain feet of the estranged; to instruct the step to find safety and certainty in the “palpable obscure,” in thy guidance, O PARKINSON!

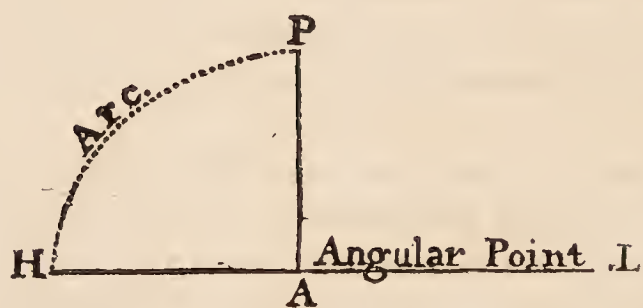
Having seen, in the observations of our friendly monitor, the nature of most substances spoken of, it now remains that we should consider them with respect to general geometrical form. Geometricians have assigned specific names to those several forms which have an existence in nature, and which for certain particular natural properties those substances are distinguished, as the cone, cylinder, cube, &c.

Solidity and *extension* are unquestionably the most distinguishing traits of nature;—and, therefore, because all matter has length, breadth, and thickness, those properties generally form the contemplation of geometricians, and they are here spoken of.

Having already mentioned the chief of the figures originally existing, as well as those assumed by nature, we shall next observe upon their general principles, at the same time defining the term

Geometry,—has been defined to be a science, originally invented for measuring the earth; the term coming from $\gamma\epsilon\alpha$, or $\gamma\eta$, the earth, and $\mu\epsilon\tau\rho\epsilon\omega$, to measure: however, it is now used in its most extensive sense;—and that art which had its origin in Egypt, for measuring the land, subsequent to the annual inundation of the country, to ascertain the boundary of each individual's possessions, is now become a science which treats generally of magnitude. It is accordingly applied for the purposes of *geography* and *astronomy*.

The *object* of geometry is magnitude; it treats of the properties of lines, surfaces, and solids. It has been determined that every surface is bounded by, at least, three straight lines, or lines which, if continued, would be straight lines; such is the *triangle*. Or else such surfaces are bounded by one or more curve lines; every solid is bounded by one or more surfaces. Two straight lines inclining to each other, and meeting in a point, will form an angle. If both the lines are straight, it is called a *right lined angle*; if one of them be curved, a *mixed angle*; if both be curved, a *curve lined angle*. If an upright line fall upon a line horizontally disposed, the upright line is called the perpendicular; the base line its horizon; and the space between the two points, or extremity of the horizontal and perpendicular lines, occupy a portion of a regular circle of 45 degrees, or its one-fourth part; which angle so formed is then called a *right angle*.



We have here expressed this angle by initial letters of the name of the lines, whilst mathematicians usually express them by such letters as $A C D$ or $B C D$, and they would say, as ours stand, $H A P$ is equal to $A P L$.

Should the angle be greater than a right angle, they call it an *obtuse* angle; and where it is less, it is called an *acute* angle.

All lines running in the same direction, which, if continued to any extent, would never meet, are called *parallel* lines. A line carried round a point, forms a circle; the point is its *centre*; the curve described,—the *periphery*, or circumference. Lines drawn from the centre to the circum-

ference, are called its *radii*. If a complete circle be divided by a line drawn through its centre, each part of the circle is called a *semicircle*: any line drawn from the arc or curve of the circle, immediately through its centre to the opposite point of the circumference, is called its *diameter*.

The circumference of every circle is presumed to be susceptible of division into 360 equal parts, called *degrees*, (marked $^{\circ}$), whilst each degree is to be divided into 60 equal parts, called minutes ($'$), each minute into seconds ($''$), thirds, fourths, or any other definite number of parts.

It should be observed, that the circle has from the most remote antiquity been usually divided into 360 equal degrees; although the moderns have believed it might be now divided into 500 or 1000 parts, for the sake of greater facility in subdivision; however, in this respect they have thought proper to retain it, and to pay a proper obedience to the division already adopted by their predecessors. The circumference of a circle is said to be *incommensurable* to its diameter, because no exact proportion between them can be ascertained. The *ratio* usually observed is 7 to 22, or 113 to 325; thus, if the diameter be 12 feet, then as 7 is to 22, so is 12 to the circumference. Which proportion that great geometrician, ARCHIMEDES, first discovered; he also squared the *parabola*, and found out the proportion between a cone, a sphere, and a cylinder, of the same height and base, to be as 1, 2, 3; so that he directed these figures to be engraved on his tomb, which *Cicero*, whilst questor of *Syracuse*, discovered, after it had been long unnoticed by his countrymen, and indeed forgotten! (thus much also for patriotism!!!) being overgrown with briars and bushes, which the Roman, although of the land of his country's enemies, had removed and restored to its pristine splendour. *Cic. Tusc. Quæst. v. 23.*

The moderns have carried their calculations of this proportion, between the circumference and diameter further, and, it is said, nearer to truth: among those the most remarkable was *Ludolf van Ceulen*, a Dutch mathematician, about the beginning of the last century, on whose tomb-stone, in imitation of Archimedes, the proportion is engraven to 36 places of figures: but since the discovery of fluxions, this proportion may be carried to any assignable length.

Any part of the circumference of a circle, is called an *arc*, and as much of the circumference as it occupies, it is said to be an arc of so many degrees.

Any straight line drawn from one end of an arc to the same point on its opposite side, is called a *chord*; and any

part of a circle cut off by a chord, is called a *segment*: any part of a circle, less or greater than a semicircle, contained between two radii and an arc, is called a *sector*.

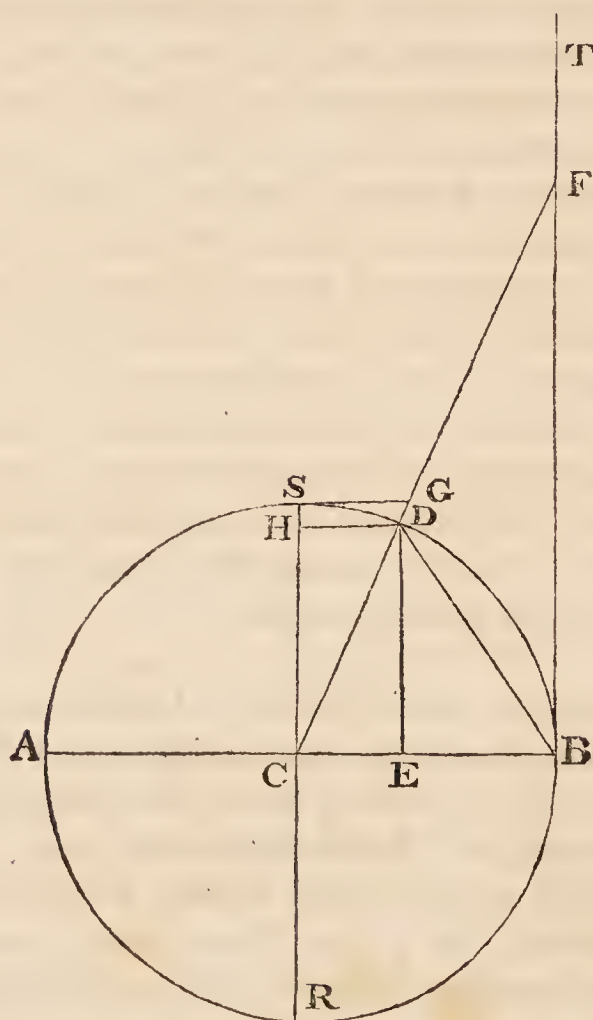
A line drawn from one end of an arc perpendicular to a diameter drawn from the other end of the same arc, is called the *sine* of that arc: the greatest possible sine is the *radius*.

A perpendicular line drawn from either end of the diameter, is called the *tangent* of a circle.

Whatever an arc wants of the quadrant, or fourth of a circle, is called the *complement* to that arc; and what it wants of a semicircle, is the *supplement* of that arc.

The sine, tangent, &c. of the complement of an arc, is called the *co-sine*, *co-tangent*, &c. of that arc.

A *right lined angle* is measured by an *arc* of a circle; described upon the *angular point* of its centre between the two legs which form the angle; thus a right angle is 90 degrees, because the arc so described is a quadrant.



In this figure, C is the *centre* of the circle; A R B S the *circumference*; the curved line B D is an *arc*, the straight line B D or D B, the chord of that arc, and B C D the *angle* of which the arc B D is the measure.

D E is the *sine* of the arc D B, or of the angle D C B.

BT a *tangent* of the circle; and BF the tangent of the angle BCD or FCB , or of the arc BD : CF is the *secant* of the same arc or angle.

The curved line DS is the *complement* of the arc BD , being as much as the arc wants of the regular quadrant BS ; and DA is the *supplement* of the same arc.

In like manner, the angle DSC is the *complement* of the angle BCD ; and the angle ACD is the *supplement* of the angle BCD . DH , the sine of the complementary angle DCS , is the *co-tangent* of the angle BCD .

CG is the *secant* of the complementary angle; and DCS is the *secant* of the angle BCD .

CS , the *radius*, is the *sine* of the right angle SCB , which having no complementary angle has no co-sine; and there can be no determined tangent or secant of a right angle.

Measures of all lines for different angles are usually found in tables calculated to facilitate trigonometrical operations.

A figure bounded by straight lines, is called a *rectilineal* figure; a figure bounded by three right lines, is called a *triangle*; if the three sides be equal to each other, an *equilateral triangle*; if two sides be equal to each other, and the third not equal, an *isosceles triangle*; if none of the sides are equal to one another, a *scalene triangle*.

A triangle having one of its angles right, a *right angled triangle*; having one of its sides obtuse, or greater than a right angle, an *obtuse angled triangle*: having all its sides acute, or less than a right angle, an *acute angled triangle*.

In all right angled triangles, the sides bounding the right angle, are called its *legs*; and the side opposite to the right angle, the *hypotenuse*.

Both obtuse and acute angled triangles are in general called *oblique angled triangles*; in which any side is called its *base*, and the other two, the *sides*.

The three angles of every triangle, when taken together, are equal to two right angles, or 180° ; and, therefore, the two acute angles of a right angled triangle, are equal to exactly 90 degrees.

That part of practical geometry, which treats of the manner of finding the proportions between the sides and angles, is called **TRIGONOMETRY**.

A figure bounded by four sides, is called a *quadrilateral* figure; if the opposite sides are parallel, a *parallelogram*; if the parallelogram be right angles, the figure is called a *rectangle*, or *right angled parallelogram*; if all the sides are

equal and the angles right, a *square*; if the sides are all equal, but the angles not right, a *rhombus* or *lozenge*.

A line joining the opposite angles of any parallelogram, is called its *diagonal* or *diameter*. In every parallelogram, therefore, two diagonals may be drawn, which in the square and rectangle are equal to one another; and the diagonal divides every parallelogram into two equal parts. A figure, nearly resembling a rhombus, is called a *rhomboid*; when the four sides are not equal, and none of them parallel to one another, a *trapezium* and *trapezoid*.

Any other right lined figure that has more sides than four, is called a *polygon*; and according to the number of its sides, *pentagon*, *hexagon*, *octagon*, &c.; if the sides are equal to each other, a *regular polygon*.

Solid figures are such which have length, breadth, and thickness; and are bounded by one or more surfaces.

A solid body, exactly round, is called a *globe* or *sphere*; which we may conceive to be formed by the circumvolution of a semicircle round a diameter, so that every part of its surface is equidistant from a point within it, called its *centre*.

A circular figure, not exactly round, is called a *spheroid*. When we suppose a solid to be formed by the revolution of a right angled parallelogram about one of its sides, it is called a *cylinder* or *roller*, and the ends of it are equal circles; but a solid, whose ends are elliptical, is called a *cyliindroid*, or *flat roller*.

A solid body, bounded by three or more plane sides, inclining gradually from its base to a point, is called a *pyramid*, or *obelisk*.

A solid, whose sides are parallelograms, and its ends two similar equal plane figures parallel to one another, is called a *prism*.

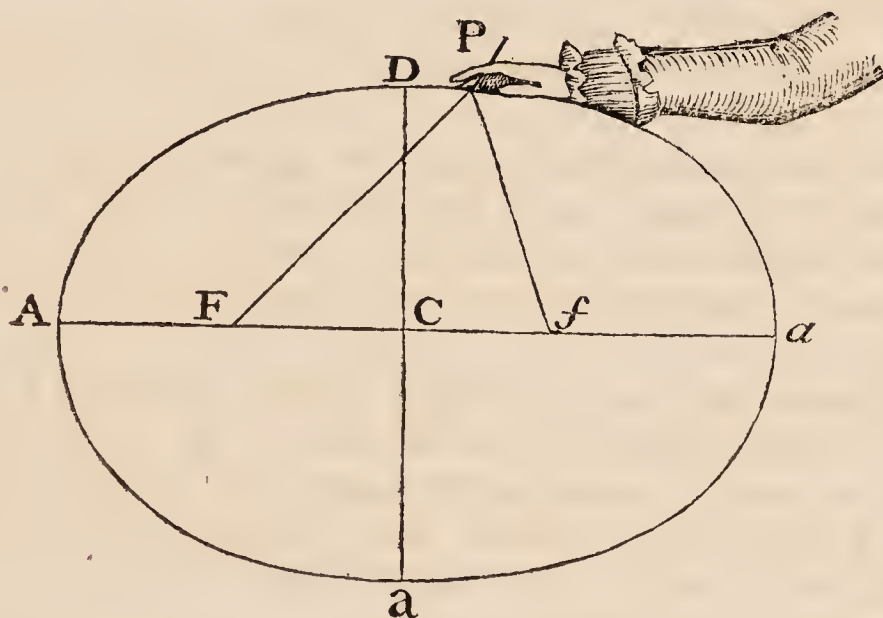
A solid, bounded by six equal squares, placed perpendicular to one another, is called a *cube*.

A solid body having a circle for its base, its top terminating in a point or *vortex*, in the form of a sugar-loaf, is called a *cone*, which may be conceived to be formed by the revolution of a right angled triangle round one of its legs. When the sides are perfectly equal, or, as is termed, when its axis is normal or perpendicular to its base, it is called a *right cone*: when its axis is inclined to its base, and its sides unequal, a *scalene cone*.

Curve lines, or figures formed by cutting a cone with a plane, are called CONIC SECTIONS; whence that part of

geometry, which treats of these curves and figures, has obtained its name: the chief of them are *parabola*, *hyperbola*, and *ellipsis*, or *ellipse*.

As a knowledge of the properties of the ellipse is found necessary for a correct understanding the motion of the planets; so is a proper conception of most geometrical figures requisite for those who would obtain a correct conception of the economy of nature in the formation of the various parts which compose this terrestrial globe. An ellipse may be described, by fixing the ends of a thread by two pins to a table, and then with a pencil still keeping the thread stretched out, marking all round the lines it describes, thus *A D* and *a a*. See figure below.



Here the curved line is called the circumference of the ellipse, and forms an oblong species of circle, for which the two points *F f*, operating as the centres, are called *focii*, or *focues*; a straight line passing through them both to the circumference, is called the *greater axis*, or *longest diameter*, as *A a*; a line passing between the focii at *C*, and crossing the greater axis at right angles, from *D* to *a*, is the *shortest diameter*, or *lesser axis*. If an ellipse is supposed to revolve on its longer axis, it will generate what is known as an *oblong spheroid*; if on the shorter axis, an *oblate spheroid*. Such is the figure of the earth.

We now touch upon some general properties of matter, which will be distinguished by the terms *solidity*, *inactivity*, *mobility*, and *divisibility*.

I. SOLIDITY and EXTENSION.—We have seen, that all matter has length, breadth, and thickness; hence every body is comprehended under some shape or figure, which hinders all other bodies from occupying the same part of space that

it possesses,—which is termed its *impenetrability*. Thus, if a piece of wood, though never so thin, be placed between two plates of metal, and those metallic plates pressed with the utmost mechanical force, they never can be brought in contact; so, if water, or even air, be introduced between those plates, the contact can never be effected until the intervening substance be removed. So, also, if a globe of the very hardest metal, have a hollow in the centre filled with water, and it be pressed with the strongest possible force; the water will be seen indeed to ooze through it, and stand in drops upon the surface.

Newton has imagined space to be void of matter; this he calls a *vacuum*: but we conceive it has been previously shown that this can exist only in *idea*.

2. **INACTIVITY**, *passiveness*, or the *vis inertia*, i.e. the want of power in a body to move of itself.—It appears to be a property inherent in substances to remain in a state of rest, until the action of some species of agency be employed to put it into motion; when, according to the situation in which it is moved, it will perhaps continue to move, and in certain situations with increased velocity; whilst in others, the progress of its motion is retarded by the operation of some extraneous cause; thus, if a body be thrown from a great height, perpendicular, it is alleged, that in proportion to the squares of the distance which it has fell, it acquires increased velocity, in a proportionate ratio to the distance; which they say is attributable to its gravity.

A body discharged horizontally, from the same cause may be supposed to be retarded in its progress, nearly proportionate to the squares of the distance it has passed, constantly inclining to the earth's surface, which is the produce of several causes: 1st, its specific gravity; 2d, atmospheric compression; and, 3d, the resistance it meets with from atmospheric particles.

An hypothesis has been adopted, that it is not so in æther, and beyond the influence of the terrestrial attraction; where, it is said, should a body be projected in a certain direction, and with adequate force, it would continue to move on in a circular direction, around the centre of solar gravitation, we suppose, for endless ages.

See motion also, subsequently considered in a review of a part of Sir *R. Phillips's* system, in the article *Water*.

3. **MOBILITY**, is the property in any body to be moved from one place to another, which must necessarily be regulated by the homogeneousness of its parts, the medium through which it passes, its adhesion, and lastly its gravity.

4. **DIVISIBILITY**, *ad infinitum*.—There certainly is no

particle of matter which can be conceived to be so small but what is susceptible of a still more minute division. The more precious metals are, however, those bodies upon which such experiments have been most generally made; therefore, to such we propose to confine ourselves. Thus, a grain of gold may be beaten into a leaf of fifty square inches, which may be divided into 500,000 parts, all visible to the naked eye. If viewed with a microscope, which magnifies the object only ten times, the fifty millionth part of a grain may be supposed to be visible. M. Reaumur, computes that a grain of gold may be extended on a silver wire upwards of half a mile in length, and that it will cover a surface of 1400 square inches, so that the thickness of the gold will be no more than the fourteen millionth part of an inch, that is 1200 times the thinness of ordinary gold leaf.

But this is certainly nothing to the infinite smallness and the subtilty of parts in odoriferous bodies; a grain of musk, for instance, will emit its particles to fill many feet of space, and continue its virtues for a whole year, or perhaps, much longer, without suffering any sensible diminution of its weight. Nor is it any thing to the minuteness of the parts of certain organized microscopic animals.

Similar opinions to the preceding facts were entertained by certain of the ancients, as to the minute divisibility of matter; vide *Cic. Acad. i. 7. Plutarch. de Placit. Phil. i. 16.* This property, however, can, perhaps in many instances, be said to exist in idea only; for infinity in minuteness, as well as magnitude, altogether exceeds human conception.

Peculiar Properties of certain Bodies.—A body not easily pierced or broken, is said to be *hard*; the contrary, *soft*. A solid body easy to be broken, is said to be *brittle*; one which can be twisted to any direction without breaking, is said to be *tough*. Some bodies are *elastic*, as ligaments of animals, properly tempered steel, and vegetable gums, which will be found to be spoken on in the preceding article on coal and bitumization. A body whose parts readily yield to any impression, and are easily moved in respect to each other, is called a *fluid*, as water, quicksilver, and also melted metals, &c.

There is also another and important property in matter, called **ATTRACTION**, which is of several kinds: cohesion, adhesion, gravitation, electricity, &c.

ATTRACTION is a general term, and applied to denote the power or principle by which all bodies mutually tend towards each other, without regarding the causes of such

kind of action to produce the effect. This is the light in which attraction has hitherto been negligently viewed. We propose to be a little more definite, and observe, that the existence of a principle of this kind is clearly manifested in numerous of the most usual *phænomena* in nature, which fall under daily observation: that it could never have escaped the piercing observation of the wise of antiquity, we are led to believe; but the information we have yet attained of their progress in physical causes, is much too slender to enable us to draw any just conclusions as to the extent of their probable discoveries respecting this power.

Anaxagoras, indeed, who flourished only about 500 years before the Christian period, is reported by *Diogenes* and *Lucretius*, to have attributed to the celestial orbs a tendency towards the earth; but then he considered the earth as the centre of the universe. Also the doctrines of *Democritus* and *Epicurus*, with others of the same school, as their very elegant interpreter, *Lucretius*, informs us; who, himself, obtained from those doctrines his opinion of the universe being without bounds, &c. Whence, it may be also collected that they believed in this species of affection in planetary motion, which, by the way, they are said to have attributed to a vital principle.

Although some few bold and original characters have conceived some extraordinary things, yet in most of their inquiries there is little definite precision as to physical causes. The best are little above hypothetical and conjectural, some nearly equally extravagant with the opinion last-mentioned. The original restorer of correct notions of the system of the universe, in Europe, was *Nicholas Copernicus*; the most rational adherent who followed him was *Kepler*, whose originality of invention, has been all swallowed up in the *Newtonian* system. But for his inventive originality, we may suppose, an infinite number of those principles we now have denominated *Newtonian*, and which that great man perfected from his profound mathematical knowledge, would never have had existence.

The first rational writer upon these themes, in this country, was that very great and universal philosopher, Lord *Bacon*, who, although no friend to the Copernican doctrine, yet his advice was calculated to benefit this science in a very eminent degree, for in his *Novum Organum*, lib. ii. aphor. 36, 45, and 58, he uniformly recommends an inquiry into physical causes and rational things, observing, “That, he
“ who shall only attend to the appetite and general affec-
“ tions of matter, (which both in the earth and heavens are
“ exceedingly powerful, and indeed pervade the universe,)

“ will receive from what he sees, preservation; and it is
 “ probable that the same power is also inherent in the sun,
 “ moon, and planets; that these bodies constantly retain
 “ their round figure, in which we behold them.” This philosopher also considered the sun as the chief governing power of the rest, as may be inferred from his words in other parts.

Tycho Brahe, who lived about the same period, on perceiving his last moments approach, desired the celebrated *Kepler*, then a young man, and his assistant at *Prague*, after he had charged him to see to the completion of his astronomical tables, (the *Rhodolphine*,) thus addressed him: —“ My friend, although I ascribe to voluntary, and, as it
 “ were, an obsequious motion of the planets round the
 “ sun, what you attribute to an active energy of that body,
 “ yet I must entreat, that in the publication of my obser-
 “ vations, you would explain all the celestial motions by
 “ my hypothesis, rather than by that of *Copernicus*, which
 “ I know you would rather incline to follow.”—*Life of Tycho Brahe*.

Kepler, in his own works, constantly maintains the doctrine of attraction, and carries it farther than *Copernicus* had done. Thus he calls gravity “ a corporeal and mutual
 “ affection between similar bodies in order to their union.” He also remarks, with *Copernicus*, against the opinions of the peripatetics, and other ancient doctrines, that the heavenly bodies do not tend towards the centre of the universe, but to the centre of those large round bodies of which they make a part. So that, if the earth were not spherical, things would not fall from all points of it towards its centre. If a stone, for instance, were to be placed at a distance from another stone, in any part of the universe, without the sphere of action of a third body, like two magnets, they would come together in some intermediate point; each advancing in space in the inverse proportion of their respective quantities of matter. Hence if the moon and the earth were not kept asunder by some power in their respective orbits, they would move towards each other, the moon passing over 35 parts of the way, while the earth passed over one, supposing their densities equal.—*Astron. Nov. Introduct.*

From the same principle *Kepler* also accounted for the motion of tides, viz. by the attraction of the moon, and expressly calls it *virtus tractoria quæ in Luna est*: adding, that if the earth did not exert an attractive power over its own waters, they would rise and rush to the moon.

Kepler is found suspecting that certain irregularities observed in the motion of the moon are owing to the conjoint influence of the earth and sun upon her body. — *Ibid.*

Kepler appears to have been the first who, in opposition to the doctrine of the schools, and which had maintained that certain bodies being heavy fall to the earth by reason of superior gravity, whilst light bodies ascended; he alleged the contrary, that *no* bodies are *absolutely* light, but only relatively so, and consequently that all bodies are subject to the laws of gravitation. So far, subsequent experiments made with the air-pump confirm this theory. He was also fortunate in tracing out the principle which prevents the planets falling into the sun; but its actual discovery appears to have been reserved for subsequent investigators, which he prophesied, when the Author of nature would permit the discovery.

The first author who wrote expressly upon the doctrine of attraction, in this kingdom, was the before-named Dr. *Gilbert*, in his *De Magneto magnetisque Corporibus*, published anno 1600; but it is said he did not make a sufficiently accurate distinction between the species, confounding common attraction with magnetical influence.

The observations of most philosophers, which we have seen, have gone no further than to that species of attraction, termed *homogeneous attraction*: we propose to endeavour to make a proper distinction, and divide it into its several species; although we may not be able, in this place, to furnish all the causes, we have yet the hope that with respect to some we shall be so fortunate.

Attraction, then, is susceptible of division into the six following species: *Cohesion*, *Adhesion*, *Gravitation*, *Magnetism*, with attraction by *Electricity* and *Galvanism*. As, in the history of attraction, the whole *genus* has been previously spoken of, as viewed by philosophers, it now becomes our duty to treat of each separately, in regard to its distinct species.

1. *COHESIVE Attraction*, which is that kind which connects bodies, as far as relates to the globe of our earth, may be justly and rationally ascribed to two species of attraction; *i. e.* by *gravitation*, which respects the *specific weight of bodies* in their tendency to the centre of the earth; and also to *atmospheric compression*. By the first species a body is gravitated proportionate to its weight; and by the second, in proportion to the squares of its surface. There is no mystery in this, since reason and experience all tend to confirm the fact.

Upon this principle, it is said, if a glass tube open at both

ends has one end immersed in water, the water will rise in it above the surface of that liquid in the body of the water, to a considerable height, which has hitherto been ascribed to some *occult quality* in the tube, called its attraction; but we submit the following attempt for its explanation:—conceiving it to be attributable to two branches of the family of this species of attraction, *i. e.* compression of atmospheric air, and the natural adhesion of particle to particle in the fluid. For, doubtless was the compression to be allowed to operate equally upon the liquid within and without, (the tubes being only $\frac{1}{10}$ of an inch in the bore), the phenomenon would not appear. Therefore, we contend, that the atmosphere falling round the surface of the mouth of the tube, the atmospheric particles are deflected or diverted from entering its body, whence we see ample reason for the appearance. And besides, the adhesion of the liquid particles to each other is another reason for their rising, one following another, as they are perceived to do in the sap of trees, and also in a piece of list, one end whereof is immersed in liquid; likewise the *syphon*, or *capillary* tube, acts upon the same principle, and from the total absence of air.

A good test to prove our conjecture upon the liquid rising in the tube would be to immerse it in a basin beneath the vessel of an air-pump.

2. *Attraction* by ADHESION is that species which is produced after bodies have come in contact, and may be instanced by the general compression of a piece of moist leather suspended to a string and compressed by any force equal to expel the intervening particles of air; likewise by friction expelling air; two smooth surfaces of brass, glass, or marble, will adhere together.

3. GRAVITATION. We have already wasted so much space upon this species of attraction, and the principle has been so long under consideration, that nothing further to its illustration can, we fear, be added; but of this the reader should be reminded, that all bodies whatever have gravity, or at least in the words of Kepler, comparatively so; for it is only owing to the atmospheric operation, that we believe one body to be light, and another heavy; for in a *vacuum*, or space exhausted of air, the smoke of a candle or a feather will fall to the bottom of the machine, which the air has vacated, as soon as will a guinea. Of this fact no doubt can exist, because experiment has proved its reality.

4. MAGNETIC *Attraction* chiefly refers to the power of the *magnet* and magnetic bodies; of which the ancients were, as has been said, acquainted. The knowledge of the

physical cause was veiled as close from their inspection as it is from that of the moderns, who are even now completely uninformed of its nature, or cause of production.

5. *ELECTRIC Attraction* is said to be the effect of a fluid constantly circulating in and collected from the atmosphere, of so subtle a nature, that it enters the closest forms of bodies, and is communicable to any number of objects or to any extent by proper conducting mediums; of this species the lightning is presumed to be composed. Its conductors are brass, iron, silver, platina, glass and gold; in fact, any close and dense body: whilst its non-conductors are of the contrary species of substances, *i.e.* woollen, silk, cotton, or any porous substance. Its effects are so well known that nothing more need be added in this place; and for further information we refer to the article, and a variety of others we have already discussed, or propose to do presently.

6. *GALVANIC Attraction*; for information upon this, we also refer to a succeeding article, which treats expressly on its discovery.

Thus we have, we hope, made some arrangement in the doctrine of attraction, which will not be found in *every* philosophical work, although we only claim what has appeared by way of explication. With respect to some other properties of bodies which are observed, it is noticed that trees have the power to change the direction of their roots for nourishment, then to resume their usual direction: that certain plants which are wholesome and commonly nutritive direct their course towards the sun; whilst others which are noxious, and sometimes poisonous, pursue a contrary direction.

MAGNETISM.—Certain bodies have properties peculiar to themselves: thus the *loadstone* attracts iron and steel only; which power the Latin name is meant to designate, being derived from *magnes, etis*, whence the name of the power is also called **MAGNETISM**.

What is very remarkable in this substance is, that it communicates its attractive virtue to a piece of steel when rubbed with it, without losing any of its own properties; another most peculiar and valuable property is, that if steel be suspended by a thread, or placed on a pivot, it readily points its direction to two cardinal points of the compass, *i.e.* north and south, whence the other points may be easily determined. The importance of the *magnet* to navigation may be hence conceived. However, it is reported that in certain situations the magnet has been known to vary, which

uncertainty was first observed by *Christopher Columbus*, in his voyage to discover America; it is said to have greatly perplexed him.

This partial variation of the magnet has not, it is said, been properly accounted for: it appears strange such variation should occur in a passage across the Atlantic; had it been, indeed, in the vicinity of Sweden or Norway, or any other country where *iron* abounds, it must have been then ascribed to the well-known attraction which exists between that metal and the subject under our present consideration.

The cause of magnetism appears to have eluded the piercing speculations of our race, and it now remains involved in as much obscurity as clothed it upon the first discovery of the object. The principle on which it operates, and where its influence terminates, are alike unknown. See also a remark to the effect of its variation upon the same local situation, in a subsequent memoir upon Gunter's line.

Amber, glass, jet, sealing-wax, and certain precious stones, possess the power of attraction and repulsion of certain light substances, which is called ELECTRICAL ATTRACTION.

ELECTRICITY was a property but imperfectly understood by the ancients; indeed, it has been said they were entirely unacquainted with it. But we propose to show the extent to which we are informed their sphere of knowledge extended. This much must be acknowledged, that they were conversant with the electrical properties of amber, because Pliny informs us, in lib. xxxvii. 3. § 12. *Arditu digitorum acceptâ caloris animâ, se succina vel electra, trahunt in se paleas ac folia arida, quæ levia sunt; ut magnes lapis, ferrum.*

Even before Pliny, as early as the days of THALES, who lived near 600 years anterior to the Roman historian, the *Miletine* philosopher ascribed the attractive power of the magnet and of amber to animation by a vital principle. *D. Laert.* i. 24. Our word *electricity* appears to be derived from the name the Latins gave to amber, *electrum*. It is also evident they were acquainted with the shock of the *torpedo*. *Plin.* ix. 42. § 67. xxxii. 1. § 2. *Cic. de Nat. D.* ii. 50. although they were as ignorant as are the moderns of the concealed cause of this effect.

It has been even said the ancients knew how to collect the electrical fire in the atmosphere; and it is asserted that it was in an experiment of this nature, that *Tullius Hostilius* lost his life. *Liv.* i. 20. Etymologists have carried

this still further back, and assert that it was from the electrical property of matter in the heavens that *Jove* obtained his surname of JUPITER ELIACUS. *Liv. ibid.* This, however, may be only conjectural.

The first discoveries made of sufficient importance to demand the appellation of scientific in the science of electricity, were effected by Dr. *W. Gilbert*: the result of which he gave the world, anno 1600, in a book then published, intituled *De Magneto, &c.* Dr. Gilbert was followed in his pursuits by that great scientific character, the honourable and illustrious BOYLE, and other men eminent for that species of information. This science has been successfully cultivated in the last century by the following eminent characters: *Hawkesbee, Grey, Muschenbrook, Drs. Franklin, PRIESTLEY*, the learned and reverend Dr. *Watson*, Bishop of Llandaff, Mr. *Cavendish*, and by several other members of our Royal Society in England; whilst those worthy of the true philosophic character in France have not neglected its cultivation.

On the 6th of August, 1753, at *Petersburgh*, Mr. Professor *Richmann* lost his life in making some experiments upon this science.

This, like many other of the *arcana* of nature, still remains as deeply shaded from human view, as when its existence was first made known. Nature appears to have certain secret operations, which are not yet, perhaps, to be revealed.

GALVANISM.—We have now to record some memoirs of a science, the principles of which remained hidden until a very recent period.

It was first accidentally discovered in the chymical laboratory of M. *Lewis Galvani*, professor of, and reader upon anatomy to the university of *Bologna*, upon the following occasion:—the lady of the professor being of a delicate habit was occasionally supported by a nutriment in soup made from frogs, as a restorative; some of these animals, skinned for that purpose, were lying upon a table in the laboratory of the professor, in which stood an electrical machine. One of the assistants, in an experiment, by accident brought the point of a scalpel near the crural nerves of a frog recently killed, lying not far from the conductor. The muscles of the limb were instantly set in motion, being agitated with strong convulsions. The experiment was repeated, several facts ascertained; and a long series of new experiments, ingeniously varied, were put in execution,

by which the law of nature, as far as respects the influence of this principle, was investigated, of which mere accident had at first afforded him a glimpse only.

His first thoughts on this subject were published for the Institute of Bologna, anno 1791, intituled, *Aloyfi Galvani de viribus Electricitatis in motu Musculari Commentarius*. On the appearance of this work, the universal attention of the philosophers of Europe was arrested. This discovery was made at a time when something more than hypothesis was necessary to satisfy the mind of the inquisitive inquirer after scientific truth. To this desire may be referred the almost innumerable experiments which were made in every district of Europe, in consequence of this publication. By which means, this science became vastly enriched by the addition of a great variety of new facts, by contemporaries and successors, insomuch that it is said, the labours of Galvani, the original discoverer, bear but a comparatively small proportion to what have been since adduced for its illustration.

Some have been inclined to award the greatest portion of merit to Signior *Volta* and the very ingenious and scientific Sir *Humphrey Davy*, who, but particularly the *first*, discovered the means of multiplying the effects which *Galvani* produced by a simple metallic communication; whilst the latter has proceeded further than any predecessor, in ascertaining these effects and investigating original principles. We should hope, however, for the sake of science, that such useless and invidious comparisons will never be encouraged; because merit of every description is entitled to its just reward. Public discrimination should be liberal, as the means of recompense are ample: the palm of merit is justly due to all those illustrious individuals; about the proportion, we are not anxious, being assured they are entitled to an ample share of judicious applause.

The origin of this important discovery is assuredly trivial; but, when it is recollected that in their original, numerous arts, sciences, &c. have had a beginning equally small, this consideration cannot be said to detract from the merit of the original discoverer; but, on the contrary, it is, in our opinion, an occasion to enhance his reputation. In the first place, it serves to show generally upon how nice grounds the most important discoveries rest; at the time, it, in this particular instance, eulogizes the alertness and scientific disposition of his mind, which could avail itself of facts arising from such trivial and apparently insigni-

ficant causes, to draw conclusions of events so very important in nature.

With reference to the improvement of systems: were those ingenious characters, who employ their knowledge in promoting the advance of sciences and the liberal arts, to have no share of retributive commendation, it were natural to presume, that many of them would want an incentive to exertion. Why then should obstacles be thrown in the way, to impede the progress of the advance of science? And, particularly, does this last observation apply to this individual instance; where the science was left in a state of manifest imperfection, by the original discoverer. And, as it should also seem the impression made upon his mind with respect to the cause, as well as to the mode of its operation, was quite erroneous;—he believing that the electric effect was in consequence of the peculiar nature of the animal substance upon which the experiment was first made; whereas by the experiments which have been subsequently performed, it has been ascertained, the direct reverse is the case; as Signior *Volta*, Sir *H. Davy*, Mr. *Nicholson*, Mr. *Carlisle*, and others, have proved from a long series of reiterated and various experiments, that the galvanic effect is produced from the association of various metallic substances, when brought in contact with certain liquids, to be after-mentioned, affording the phænomenon. The first discoverer of this fact was Signior *Volta*, who constructed a pile of alternate plates of zinc and silver, with pieces of moistened cloth between each pair of plates. *Volta* made these discoveries in 1800;—his arrangement has since obtained the name of the *Voltaic* pile. He found the effects of this pile much more powerful when the liquid employed was a compound of common salt and water, rather than common water. A pile consisting of forty pair of plates he found to possess the power of giving a very smart shock, similar to that of a small electric jar.

Beyond this, and beyond the effect of his metallic arc, which consisted of placing two pieces of metals of different kinds in different parts of an animal at the same time, that, when the metals were brought in contact or connected by a metallic wire, as often as the contact was made, convulsions were observed,—he discovered that the greatest effect was produced when the metals employed were zinc and silver. When several pairs were employed, separated by pieces of moistened cloth, it should be noticed that the effect was increased according to the ratio of the number of pairs.

It appears that here Signior *Volta* left it, as we hear no more of that celebrated philosopher's experiments. It yet remained to be perfected in *this* country, and the first material discoveries made in it here, were by Messrs. *Nicholson* and *Carlisle*.

After those gentlemen had observed these effects, already ascribed to those piles, on bringing the wires from each end of the column in contact with a drop of water, they discovered the disengagement of bubbles of some elastic fluid; closer observation enabled them to discover that the gas discharged was *hydrogen*: they then took a glass tube of about half an inch diameter, in each end of which a cork was inserted; the tube being filled with water, through each cork was introduced a brass wire, so that the ends of the wires inserted into the glass were about $1\frac{3}{4}$ long. The pile employed consisted of 36 half crowns, and as many similar pieces of zinc and moistened pasteboard. The zinc end of the pile was then connected with one of the wires of the tube, and the silver end with the other: so that the circuit formed by the pile and the wires was separated by the water, a stream of bubbles was observed at the end of the wire in the tube, connected with the silver end of the pile, and gas proceeded. No gas was disengaged from the opposite wire, but it became speedily tarnished, first of an orange colour and ultimately black.

The tube was then reversed, when it was observed that the wire, which in the first experiment had become tarnished, gave out bubbles, whilst that which formerly yielded them in its turn became also tarnished.

The emissions of gas from the wire connected with the silver end of the pile, were constant and uniform; except when a metallic circuit was formed between the ends of the pile, during which no gas whatever appeared. It was observed that when the metallic conductor was removed, the appearance of gas ceased, which was not immediate, since there was an interval of about two seconds between the removing of the wire and the appearance of bubbles. After this process had continued two hours and a half, a bulk of gas was produced, equal to two-thirds of a cubic inch. This gas was mixed with an equal bulk of common air, and exploded upon the application of a lighted taper.

These ingenious experimentalists, supposing the phenomenon in question to arise from a decomposition of the water, thought it surprising that the hydrogen should make its appearance at a distance of an inch and a quarter from

the point where the oxygen was disposed of. An infusion of *litmus* was then used in the water, and with a longer tube, when the fluid at the zinc end of the tube became *red*, and hence they were led to suppose that an acid had been produced. At the other end the fluid was not changed in colour, but gas as usual was evolved.

The final result of this experiment, in the opinion of Mr. Nicholson, was that the zinc end of the pile was in a *plus* state of electricity, and its opposite in a *minus* state.

The experiment was then varied, by substituting wires of platina in the stead of brass. It should be particularly noticed, that under this circumstance both the wires gave out gas, and neither of them were tarnished. On examination, the gas from the silver was found to be hydrogen, as before, and from the zinc oxygen. Their proportion was found to agree with the component parts of water. It should be recollected that the silver end emitted here the larger proportion of gas.

The mystery of galvanic energy, was much elucidated by certain experiments, made by Mr. Cruickshanks, of Woolwich, who employed in his experiments a pile, consisting of from 40 to 100 pair of plates of silver and zinc, about $1\frac{1}{2}$ inch square. By these, and the aid of silver wire, the chief fact he developed was that he discovered the zinc end of the pile emitted an *acid*, whilst the silver end discharged an *alkali*.

Mr. Cruickshanks next employed gold wires as conductors of the galvanic fluid, in which experiment he discovered that the proportion of oxygen now became much greater, than with the silver, as the gold was not susceptible of oxydation in the process.

The next attempt of this ingenious gentleman was to collect the gas separately for which purpose he invented a machine, which answered his views. He tried various experiments upon acid and alkaline solution of metals, which may be seen at length in the philosophical publications of the day, and several cyclopædias and other scientific works.

But the greatest benefit the world received from this gentleman's scientific exertions, is derived from his invention of the galvanic *trough*. This consisted of a wooden box of width and depth agreeable to the size of the plates, which are arranged at such a distance, that when they are admitted into the grooves passing across the sides and bottom for their reception, at such a depth and breadth between the plates, as to form a number of cells or compartments of about three-eighths of an inch wide. Each

of these plates were composed of a plate of zinc and another plate of copper, or silver, soldered together, and so arranged that those metals were brought in opposition to each other; so that the metals thus arranged might be considered as a galvanic pile, placed horizontally, the cells being made for the reception of a fluid to answer the purpose of wetted cloth, as used in the Voltaic pile.

So convenient was this apparatus discovered that its use has been generally adopted in experiments; and, in fact, it has now superseded the pile in most countries of Europe, as well as in the British empire, except indeed for particular purposes.

This trough of Mr. Cruickshanks usually consisted of 50 pair of metallic plates, and constructed as previously described, as applicable to these purposes: usually connecting the influence of the positive and negative sides of the galvanic material, by steel wire, which material also usually operates as a conductor of the fluid to the object of the operator's design.

By these means the nature of the fluid may be ascertained, as it is evidenced to our visual sense, for the moment these wires are brought in contact with the metals, a vivid spark will be seen as the effect, with slight scintillations; phosphorus becomes inflamed; metals are deflagrated; a decomposition of all the most closely connected of materials takes place; and, the chymical components of elemental nature will be made manifest. Such accidental mixtures, which occur in what are considered as the elementary parts of nature, may be by the means of this very powerful chymical agent ascertained. Upon the decomposition or deflagration of metals, the most beautiful and vivid colours are produced, of various appearance, according to the nature of the metallic substance. Nothing in nature or art can have a finer effect, than has these experiments.

At about this period of the galvanic process, *i.e.* at the time its uncommon powers were first developed, a question naturally arose between the philosophic world, as to the precise nature of the fluid to which these effects are to be attributed. Some supposed it to be purely electrical, whilst some doubted the identity of the two fluids, particularly as far as related to galvanic effects. Many very ingenious and very expensive experiments have been made by a great number of the ablest chymists; but as far as the result of their experiments have been reported, or at least as far as those results have come under our observation, we do not understand that any thing satisfac-

tory or decided has been determined upon, to furnish a perfectly unobjectionable result in this respect, or to define the accurate or probable criterion.

At this juncture of public uncertainty, the best means were afforded the scientific world for obtaining every information, which liberality could afford, or perhaps scientific skill accomplish, in a public institution, called the *British Institution*, which had then for its chymical professor the very eminent and indefatigable Sir Humphrey Davy; whose long experience, as a practical chymist, and his successful enterprise in the labours of science, seem particularly to have qualified him for the arduous duties of filling the professional chair with ease and with dignity; at the time it afforded the public ample room to expect the happiest consequences to result from his acknowledged talent.

Conscious of the importance of the task, this able scientific character had to perform, and knowing how much was expected from his exertions, in this respect, Sir Humphrey began a course of experiments, which for professional skill, unwearied patience, and in the satisfactory result, has been rarely equalled, scarcely ever surpassed. Without following the course of these great labours, we may perhaps obtain our proposed object, by taking such notice of what we humbly conceive to be the chief facts which occurred in the course of his scientific researches;—in doing which we may be found to discharge our duty to the public as historians, and to achieve the cursory view, we first proposed to take of the science.

From the first result Sir Humphrey ascertained, that the genuine effects of this species of electricity, was the reverse of that cherished by Volta, and his illustrious predecessor, the original discoverer; *i. e.* that dissimilar metallic substances were necessary. The British chymist discovered that from one metal only, with different fluids, *i. e.* to place one side of the metal in an oxydating fluid, and the other in a liquid of a de-oxydating quality, having these two liquids separated by one of a neutral nature, which he effected by this arrangement; *i. e.* sulphurate, metal, potash, and water as the intermediate and neutral liquid.

The experiments made by Sir H. Davy were generally performed by 100 or 150 pair of 4-inch plates, and occasionally of 6 inches square; the liquids used were various, and calculated to answer certain specific effects; as the liquids before named, solution of alum, and other fluids, affording an acidifying operation upon the metals; using gold,

platina, silver, copper, and occasionally steel wire, for connecting the positive and negative ends of the battery, and for conductors of the fluid. The recipients for the galvanic effects were sometimes made of gold, agate, glass, muriate of barytes, clay, wax, and other substances; from whence a great variety of experiments were made, and numerous conclusions drawn. And from whence, he discovered that the nature of the galvanic fluid is admirably adapted for a grand chymical agent in dissolving concretions of various materials, deflagrating metals, decomposing most substances, analyzing and reducing all things to their elemental components, &c. &c. The powerful agency of this fluid upon the nervous and muscular construction of an animal substance, may be ascertained from the annexed note, recounting experiments made by Dr. Urie, at Glasgow, in last November.¹

There are only some few parts of the material world upon which we have yet bestowed that attention, which we had at first intended;—of those parts which remain, we have therefore, now to speak.

WATER, — according to our arrangement, now claims attention. Having already spoken of the renovation of water, after it had been an occupant of the earth, and brought again to a state to be serviceable to nature, we have now to describe some of its very peculiar properties; this element may be decomposed by another elemental force to which all nature submits, the electric or galvanic fluids, but the latter is chiefly employed;—when water is dis-

¹ On the 4th November, 1818, various experiments were made upon the body of the murderer, *Clydersdale*, by Dr. Urie, of Glasgow, with a galvanic battery of 270 pair of 4-inch plates: the results were truly appalling.

On moving the rod from the thigh to the heel, the knee, previously bent, was thrown out with such violence, as nearly to overturn one of the assistants, who in vain attempted to prevent its extension. In the second experiment, the rod was applied to the *phrenic* nerve in the neck, when laborious breathing instantly commenced; the cheeks heaved and fell, the belly was protruded and collapsed with the relaxing and retiring diaphragm; and it was thought, but for the complete evacuation of blood, pulsation might have occurred! In the third experiment the *superorbital* nerve was touched,—when every muscle in the murderer's face was thrown into fearful action: the scene was hideous,—several of the spectators left the room,—and one of the gentlemen actually fainted from terror or sickness. In the fourth experiment, the transmitting of the electrical power from the spinal marrow to the *vertebraic* nerve at the elbow, the fingers were instantly put in motion, and the agitation of the arm was so great that the corpse seemed to point to the different spectators, some of whom feared that it had come to life! Dr. Urie appears to be of opinion, that had not incisions been made in the blood-vessels of the neck, and the spinal marrow been lacerated, the criminal might have come to life.

covered to yield all the various gases, in some proportion or other; but chiefly hydrogen, oxygen, and carbon; but in most waters the two former are chiefly prevalent, occasionally the latter is also found; pure aquatic particles, with an occasional residuum of earths and metals, when those substances are held in solution: those earths and metals are of various natures, and must, of course, specifically participate of those substances through which the waters have passed: it also yields, in certain quantities, various salts; their specific nature are also regulated, of course, by the recent consideration.

The relative proportion which water bears to its associate, the earth, we do not recollect to have seen; but submit the probability of the following proportion to our geographical and philosophical readers. Perhaps it is as 5 to 3; but taking into consideration that the immense mass which would be formed were all the aquatic particles aggregated which are found to commix with almost all substances, above and below the earth, in animals, vegetables, and minerals, as well as in the native springs in the earth's interior, and also those immense volumes of water which are found floating in the atmosphere;—we think we shall not greatly err, by assuming an hypothesis that the parts are as 6 to 4, making an aggregate of 10.

With respect to its elemental form, previous to congregated association, we have already seen that it assumes an elliptical or globular shape, exactly conformable to the atomic cosmogony of *Mochus*, and his disciples *Leucippus* and *Democritus*.

Although the favourers of systems, with minds impressed with very exalted ideas of those truths which bear relation to those sciences and arts with which they are most conversant, from a constant contemplation and habitual admiration of their perfections, at last very naturally conclude that there are very few truths of much importance out of their sphere; this arises from the very limited powers of the human mind, which is not in every individual calculated to embrace the vast,—and, at the same moment, attend to the minutiae of things: hence certain very valuable intelligences have preferred one species or other of truth to the neglect of all others. We shall at present confine ourselves to one who prefers chymical, and another who decidedly judges that all excellence lies in philological truth. Those authors we select are, the original author of the *Philosophical Journal*, and the justly estimable and truly erudite author of *Hermes*. Mr. *Nicholson* accordingly taunts the favourers of

the atomic cosmogony; we would ask him—Why are atoms and corpuscles named in physical considerations of the structure? we see no other reason, than because it is not fashionable;—for fashion prevails even in philosophy. And Mr. *Harris*, in his turn, smiles at the chymist and his alembic, with his whole chymical apparatus; who intends to confine truth within the narrow bounds of the utensils of his art.

We have been, perhaps, so unfortunate to embrace the MOCHÆAN system: having yet seen no cause to retract our former ideas, we cherish them still, and shall hold them until we are thoroughly convinced of their fallacy. In our review of the elemental parts of nature, we see every occasion to confirm our former impressions. The public are assured that truth was our object, and will, we hope, remain satisfied that it is the most remote from our intention to mislead them. Tenaciously shall we hold our present ideas, until we see a more perfect system, having a stronger claim upon our credibility.

The general laws which direct fluids, are called *statics*, or *hydrostatics*,—the etymology of which term implies their relative proportion to some other thing; and, consequently, that they may be weighed.

In water, also, the *hydrostatic balance* is used, which affords the most perfect mode to ascertain the purity of metals: originally invented by Archimedes to weigh a crown of gold, when its purity was suspected, for his relation Dionysius, the Syracusan tyrant; the idea occurred whilst the philosopher was in a bath, from observing the quantity of water his body displaced.

However, one of the chief distinctions of this element from all other elemental and compound substances, remains to be noticed; which consists in its ready obedience to the influence of some other and distant object, producing the phænomena called TIDES. We shall presently have occasion to take notice of the opinions of the ancient philosophical writers, and also subsequently to notice such of the most respectable and prominent opinions which have come to our knowledge, and transpired since the period of the ancients.

Cicero ascribes the production of tides to the attraction of the moon. *Divin.* ii. 14. *Pliny* alleges that the sun and moon have an influence, judging from his words, *causa in sole lanagues*, *Plin.* ii. 97. s. 44: the flux and reflux of the tide he terms *astús accessus et recessus*; which takes place twice in every lunar day of 24h. 50m. or the period which elapses between the instant the moon leaves a given

point in the heavens, say the meridian of Greenwich, until she arrives at the same point again. It is observed, that the tide rises higher than ordinary, those tides so arising are called *spring-tides*; and when lower than usual, they are then named *neap-tides*: both happen twice in every month, at the new and full moon;—when the force of the sun and moon operate in conjunction on the water of the ocean, the former is produced; and the latter is occasioned when the moon being in quadrature, the influence of her attraction is diminished by the opposite influence of the sun. The tides are said to rise highest near the equator, as might be naturally supposed, their effect being ascribed to the preceding cause, the influence of the two chief luminaries. The tides are also, of course, more perceptible near the mouths of rivers and on the coast, than they are upon the open sea.

Tides are also constantly varying not only from the natural surface of the waters, but they are differing with respect to each other; and, it is observed, that some of these variations are regular and periodical; whilst others are unequal, with respect to quantity, and uncertain as far as has relation to time. Consistent with this remark, it is found that the rise and fall at *Plymouth*, for instance, frequently varies 21 feet in the same day; whereas the difference sometimes is only about 12 feet. In *Fundy* bay, North America, they are said to rise to the height of 60 feet.

Notwithstanding what has been said, with respect to uncertainty in tides, it is also alleged, that from the highest tides they are observed to decrease afterwards progressively till they come to the lowest; but this point those, whose experience enables them, are best qualified to adjust.

The next greatest height to which these tides are known to rise, admitting the truth of the American, is at the conflux of the Indus with the ocean, where it rises, as reputable authority assures us, 30 feet. Hence the astonishment which pervaded the minds of Alexander and his army, which is related by *Curtius*, ix. 29, at this extraordinary appearance, may be adequately conceived.

In those seas which are joined to the ocean by a strait, as the Mediterranean, Baltic, &c. tides are said to be scarcely perceptible.

The revival of the ideas of Cicero and Pliny, in modern Europe, is to be ascribed to Copernicus and Kepler, as we have seen in a preceding article, (*Astronomy*.) These opinions have been further illustrated, and, it is alleged, accounted for, by Newton, who is reported to have, with his usual sagacity, solved several difficulties upon this subject, before thought inexplicable.

Consequences.—From the motion of tides, the waters of the ocean are kept from putrefaction,—thus the existence of those myriads of animals which people the ocean is preserved. Although the tides are fluctuating and uncertain in small seas and on their shores, yet they are said to be constant and moving with an equal motion in the body of the great ocean, flowing westward, and following the direct course of the moon, which has been observed by various navigators, and particularly in those straits which join one ocean to another. Besides this general motion in the great body of waters, produced by tides, there are other certain local motions found in various places, called *currents*. There is one along the coast of Guinea, from west to east, so strong that a passage with the current will occupy a space not exceeding two days; against it, will consume a period of six weeks. This current does not extend to above the distance of fourteen miles from the shore; and was, in former times, the cause of destruction to several ships, before the mariners were acquainted with it; driving their vessels upon rocks, shoals, &c. or from the tedious length of the passage, occasioning famine, both equally productive of destruction. There are also very strong currents between Madagascar and the Cape of Good Hope, and in several other parts; but the most remarkable are said to be within the straits of Gibraltar and in the Cattegat, where, it is alleged, there are two currents, an upper and an under one; however, it is upon this principle, the equality of the waters in the Mediterranean and the Baltic have been accounted for, although with respect to the former of these seas, the vast accession of water it receives from the numerous rivers of Europe, is very satisfactorily ascertained by the remarks of Dr. Halley on the principle of solar absorption, exhalation, or evaporation. It has (in his memoir before given) been observed that he established an equilibrium between the expenditure and receipt of the ocean.

Because Sir Isaac Newton's opinions upon the subject of tides are found not to differ materially from those of Kepler, which have already appeared; and since Newton's ideas upon this subject, in particular, have been those we have portrayed, his name is not specifically mentioned as the author of any new opinions. To this great character we are proud to confess large obligations, although there are certain points, in which, we conceive, he does not always agree with nature; we are happy in the opportunity to confess our general obligation, and soberly to offer our share of praise.

Sir Richard Phillips has recently published some opinions upon the subject of “*The proximate mechanical Causes of the Phænomena of the Universe*,” wherein he attributes all the general phænomena of motion in the physical creation of this our globe to the evolutions of the earth upon its axis; and with respect to all other motion, as transferred from body to body through the universe. He considers *tides* as produced by the diurnal rotary motion of the earth upon its axis, conjoined with solar and lunar attraction, as we shall presently perceive from his opinions. The emotion produced in the waters of the ocean are termed TIDAL WAVES, observing that species of expression is best calculated to convey the sense of the appearance; for he alleges, that tides do not consist of a general rising of the waters of the ocean, but the term *wave* he thinks best adapted to define the gentle undulatory motion which it in reality forms.

The causes and phænomena of the tides, according to this system of Phillips, may be described in the subsequent paragraphs:—

“1st. The tides are primarily nothing more than vacillations of the waters, caused by the two-fold motion of the earth, and by the constant re-action of land during the rotation of the whole terrestrial mass of fixed and fluid materials.

“2d. There are two tides in opposite seas of the earth at the same time, because there are two great seas in motion, and two continents acting and re-acting on the two moving seas.

“3d. The oscillations move backwards and forwards within every six hours;” but we should think this observation applies to narrow seas only; it cannot surely be said so of the great oceans; for were the aquatic motion to be continued with that velocity, it would be nearly equal to the progression of the swiftest planet in its orbit. It would be, indeed, a thing which does not happen. “Consequently, the space moved over by the same waters in each vibration is equal to the rate of motion per hour, multiplied by six, which oscillation in the British Channel is from 36 to 42 miles only.

“4th. This, therefore, is the breadth of the great tidal waves, or oscillations of the ocean; consequently, there are 35 or 40 of these tidal waves following each other in succession across the Atlantic, and from 75 to 100 such in the Pacific Ocean, according to the several rates of motion, arising from various combinations of land, rocks, and water.

“ 5th. Their connexion with the moon and sun is a consequence of the cause of all motion being the same ; and of the necessary balance of forces, which exist in a system of universal motion, in which all bodies are forced to move around circles of such radii as are calculated to produce in each of them uniform momenta.

“ 6th. Of course, as it is the oscillation of the great tidal waves that creates the local tides, whatever adds to the volume or velocity of a tidal wave, when moving from east to west produces similar effects, whilst the same volume moves back from west to east ; consequently, one spring-tide or one neap-tide, or one tide of any kind leads necessarily to a returning tide of the same quantity ; and there is no occasion for the operation of any new power to produce a recurring peculiarity, allowing the same rotation.

“ In fine, it is intended to be asserted in this paper, that the phænomena of the tides are mere phænomena of MOTION, and as such are proximately caused by MOTION ; that the proximate motions or causes concerned in their production are the rotation of the earth around its own axis, and around the centre of the momenta of the earth and moon, and the sun ; no attraction, gravitation, or other occult force being concerned or being necessary.”—*Monthly Magazine, March, 1819.*

The following are some of his general principles, and as they have immediate reference to the object which now engages our attention, they appear in this place, and are extracted from a sheet which bears the title of “ *Popular Abstract of the new System of Natural Philosophy, proposed by Sir Richard Phillips.*”

“ All the phænomena of nature consist of various affections of *matter*, created by various degrees and modifications of motion.

“ Without motion, as variously transferred from *system* to *system*, from *body* to *body*, from *atom* to *atom*, matter would be a fixed unchangeable mass, exhibiting no phænomena : motion is therefore *the animating and preserving soul of the material universe.*

“ *Matter, form, and motion*, are the sufficient sources or proximate causes of all material phænomena ; and this fundamental truth cannot, it is presumed, be disturbed, though many of the following exemplifications should be unsatisfactory or erroneous, or though some circumstances or peculiarities of certain phænomena may for ever remain untraced or unexplained.

“ *Motion*, as applied to different bodies under different

circumstances, produces various kinds of phænomena. Thus, when any force of impulse is applied to an *aggregate*, which is opposed by bodies susceptible, by the form of their atoms, of receiving and transferring motion, also a solid surrounded by fluids, mere change of place in the aggregate is the result, and the quantity of motion or force transferred during the progression to successive particles of the surrounding fluids. When the susceptibility of receiving motion in the opposing body is less than the power of its cohesion, as the mechanical strength of the impelled or moving aggregate, it is broken in pieces by the force of impulse; because, as its parts cannot, in this case, diffuse their acquired motion in the direction of the impulse, they seek other directions in which to diffuse the motion. But, when the cohesive or combined strength of the atoms exceeds the force of the impulse and the re-action of the opposing bodies, then the impulse produces an intense vibration or internal agitation of the *atoms* of the aggregate, one among another, which creates the sensations, first, of heat, and if reiterated and accelerated, the phænomena of light and combustion.

“ The *Tides* and *Winds* are mere phænomena of motion, and nothing more than oscillations of the fluid or moveable parts of the terrestrial mass, arising from the re-action of the fixed or concrete parts; and the simultaneous action of necessary coincidence of the rotation of the moon and tides arises from the causes of both motions being the same.”

Having now collected the chief opinions upon the phænomena of tides, we make one observation upon what has preceded only; *i. e.* that it appears extremely probable, considering the confessed influence of the three alleged causes of their production, that to neither one is the phænomenon to be ascribed entirely, but to the joint operation of solar and lunar influence, and also to the rotary motion of the earth on its axis: and thus from the combination of these effects sometimes opposing each other, and at others, all operating in exact unison, the great variety of appearances in this phænomenon may be satisfactorily accounted for. But as these must be regulated by the peculiar local circumstances attending each separate incident, from these, of course, must conclusions be drawn of satisfactory solution.

ESSENCE, in philosophy, is defined, by Mr. *Nicholson*, to be that which constitutes the particular nature of each genus or kind, and distinguishes it from all others; being

nothing but that abstract idea to which this name is affixed; so that every thing contained in it is *essential* to that particular kind.

In chymistry, it denotes the purest, most subtle, and balsamic part of a body; extracted either by simple expression, or by means of fire, from fruits, flowers, and the like. Of these there are great variety used on account of their agreeable smell and taste, by perfumers, apothecaries, and others. Those extracted by means of fire, with more propriety are to be accounted among essential oils.

Means of obtaining various Essences.—Bergamot, is a fragrant essence extracted from a fruit produced by grafting a branch of lemon upon a stock of the bergamot pear, generally imported from Italy and Sicily, particularly from Reggio and Messina. This spirit is obtained by paring off the rind of the fruit with a broad knife, pressing the peel between wooden pincers against a sponge: as soon as the sponge becomes saturated, the volatile liquid is squeezed into a phial.

The essences of orange and of lemon, are prepared in a similar manner.

Alcohol is a term applied by chymists to the purely spirituous part of liquors that have undergone the vinous fermentation. It is in all cases the product of the saccharine principle, and is formed by the successive processes of vinous fermentation and distillation. Various kinds of ardent spirits are known in commerce, as brandy, rum, &c. but they differ in colour, taste, smell, &c. The spirituous part, however, is the same in each, and may be procured in its purest state by a second distillation, which is termed *rectification*.

Alcohol is procured most largely in this country from fermented grain-liquor, but in France and other wine countries, the spirit is obtained from distillation of wine, hence the term *spirit of wine*.

Alcohol is a colourless, transparent liquor, appearing to the eye like pure water. It possesses a peculiar penetrating smell, distinct from the proper odour of the distilled spirit, from which it is procured; to the taste it is extremely hot and burning, but without any peculiar flavour. From its lightness, the bubbles which are formed by shaking subside almost instantaneously, which is one method of judging of its purity. Alcohol may be volatilized by the heat of the hand. It is converted into vapour at the temperature of 55° Fahrenheit, and boils at 165°. It has never been frozen by any degree of cold, natural or artificial, and on this

account it has been much used in the construction of thermometers. Alcohol mixes with water in all proportions, and during the mixture it is extricated, which is sensible to the hand. At the same time there is a mutual penetration of the parts, so that the bulk of the two liquors when mixed is less than when separate; consequently, the specific gravity of the two liquors taken apart will be as follow:

Alcohol is supposed to contain of	Carbon,	28.53
	Hydrogen,	7.47
	Water,	64.0
		100

Its uses are many and important; it is employed as a solvent for those resinous gums which form the basis of numerous varnishes. It is also employed as the basis of artificial cordials and liquors, to which flavour and additional taste are given by particular admixtures; it serves as a solvent for the more active parts of vegetables, under the form of tinctures. The antiseptic power of alcohol renders it peculiarly valuable in preserving particular parts of a perishable substance in anatomical preparations; the steady and uniform heat that it affords during combustion makes it a valuable material for burning in lamps.

ÆTHER.—The action of the more powerful acids in alcohol gives rise to this order of compounds, and renders them of some importance from their peculiar properties. These, as produced by the different acids, vary somewhat in their qualities: they all agree, however, in the possession of certain general properties; they are highly volatile, odorous, pungent, and inflammable, miscible with water, and capable of combining with alcohol in every proportion. These compounds are named æthers, the specific name of each being derived from the acid, from the action of which, on alcohol it has originated: as, sulphuric, muriatic, or acetic æther, &c.

As we cannot find room to give the separate modes of preparation of each species, the reader is respectfully referred to that scientific work, NICHOLSON'S ENCYCLOPÆDIA, article ÆTHER, where he will find each mode described.

GAS. *On the production of Gases.*—It has already been stated that most substances yield gas: we have now to add, that there is *no* material substance in the creation but what affords it in some proportion or other, and that numerous substances yield gas of several different natures, specifically

denominated by separate names. An ingenious, and the most extensive pneumatic chymist in London, informs us, that he manufactures no less than thirty-two different species for medicinal purposes alone. He says, the numerical amount of gases is immense. However, the most general, and, at the same time, the most important in nature, are *oxygen*, or pure vital air; *carbon*, or the anti-ignitious principle; *hydrogen*, or that which is generally found in water; *azotic*, the vicious, impure, or bad; and the entire of the acid gases, &c.

Further Division of the Terraqueous Globe.—Definitions, &c.—The various substances which occupy this globe, are usually also divided into animate and inanimate. A description of these bodies constitute NATURAL HISTORY, as that of *Pliny*, *Linnæus*, &c. Animate bodies are distinguished from the inanimate by the properties of *sensation* and *voluntary motion* conjoined.

Animate bodies are divided into such as have *red* blood and such as have *colourless* blood.

Those having *red* blood are again distinguished into *hot* and *cold*.

Also, those animals possessing hot blood are either *viviparous*, or *oviparous*.

The VIVIPAROUS all suckle their young, and the class which comprehends them is denominated by Linnæus, MAMMALIA, or *Animalia*. This class comprehends man, quadrupeds, whales, and some other sea animals.

The OVIPAROUS, with warm red blood; are *birds*.

Those animals having cold red blood are divided into such as have lungs, and breathe; or into such as are destitute of lungs, but are furnished with gills, which serve the place of lungs. The former of these furnish the class called *Amphibia*, which comprehends *serpents*, *lizards*, *frogs*, *tortoises*, &c. The latter constitute the class called FISHES.

The animals with colourless blood, are either furnished with a crust, or covering, or else they are naked; the former are the oyster and other shell fish, and also innumerable insects; whilst the latter includes the extensive class of *Vermes*, or worms, &c.

Additional information upon each of these classes, &c. follows. *Zoology*, although it literally means a *description of animals* in general, has been confined occasionally to denote the description of quadrupeds only; while description of

birds has been termed *Ornithology*; of amphibious animals, *Amphibiology*; of fishes, *Ichthyology*; of insects, *Entomology*; of worms, *Helmithology*. Natural historians have further increased these terms, by denominating those descriptive of shell fish, *Conchology*; of serpents, *Ophiology*; &c. and if confined to any particular part of an animal, as bones for instance, they have called it *Osteology*, &c. The science which treats of the structure of animals is called *Anatomy*.

As a general term, that science which treats of the physical construction and function of bodies is termed *Physiology*.

The several parts of nature are either *organic* or *inorganic*, and *inanimate*.

Organic comprehends the animated bodies before spoken of, and subsequently enumerated; and also all vegetable substances possessing life.

The inorganic comprehends those portions where no specific organ or medium is found, whereby the preservation of the creature can be discovered as dependent upon the certain operation of physical causes.

The *inanimate* embraces all those portions of material substance, the operation of whose functions have either ceased to exert their power, or which are by nature distinguished for the *vis inertiae*, as earths, metals, stones, &c.

Vegetables possess many properties with animals, some being to be only distinguished from animals by mere *locomotion*. Like animals, too, vegetables have the distinction of sex, which the ancients knew; for figs, which were a considerable article of commerce, as well as food, in antiquity, they knew could be improved in size and quality by the process called *caprification*, described by *Pliny*, xv. 19. s. 21. which consisted in applying the barren flower of the male fig-tree, (*caprificus*,) to the female fig-tree, (*figus*.)

The difference of sexes in plants is to be distinguished by the conformation of the flower. This conformation serves as the foundation of the justly admired system of botany established by *Linné*, the medical professor at Upsal, in Sweden, who died A. D. 1772.

Vegetables are propagated by seeds and transplantation. Besides this last operation, there is another chief distinction of them from animal nature; because a root may, under favourable circumstances, be divided, and both parts, notwithstanding the separation, will possess the function of retaining vegetative life; and if care be taken, they appear to suffer no injury from the severing process. This faculty can also

be sustained by that class of animals called worms, or the *vermiscular* division of nature. The process of vegetation depends upon moisture, air, light, and heat. Of these, some are of vital importance to the very being of the plant; all which depend upon certain specific circumstances.

The nourishment which plants receive is absorbed by the roots. This nutriment chiefly consists of moisture, which is conveyed by certain ducts or canals to every part of the plant, variously modified and divided into separate juices applicable to its various parts, not only in different plants, but also to divers parts of the same plant; as that which affords support to the rind and leaves is generally bitter and astringent, whilst that conveyed to its fruit is mostly of a saccharine quality, regulated by its specific nature; which facts may be ascertained by the experiment of tasting those juices. It should be noticed that there often exudes from fruits a mild gummy liquor, which sometimes extends to the very branches, often observable in the plum-tree, and others of that species. By artificial means plants may be made to grow one upon another, where the nature is in any way homogeneous, by a process called *budding*, or *engrafting*.

The means by which the separation of those various juices applicable to different parts of the same plant is effected, are among those secrets still withheld by nature. We have never heard that the most attentive and ingenious naturalist has yet ascertained the means by which these several operations are performed. But experience convinces us of the fact: for the same earth from whence the nutriment is drawn which supports the most wholesome vegetables, will also yield support to hemlock and the deadly night-shade. For particular observations on these, botanical writers must be consulted.

The substances obtained from various animals and vegetables are very dissimilar, even with respect to the same individual; and as these respects different individuals, they are consequently no less various. Much in these preparations is owing to the ingenuity of man and human industry.

ANIMATED NATURE.—What has been observed by natural historians of sympathies and antipathies in material nature, will, perhaps, be found to hold good with reference to spiritual and immaterial existences. However, it has often been seen, that as great and noble minds have the power sometimes to encourage in other minds desires and pro-

pensities similar to their own emanations; so will it also be much more generally found that the ill principles of companions are insensibly imbibed by those who have the misfortune to fall into base or bad company.

There are, it is most true, some few instances to the contrary of the preceding assumed positions, for instance, that of *Nero*, who, although he had the wise and gentle *Seneca* for an instructor, was himself a monster of the vilest depravity. Also there want not many instances of the reverse of the last, where preceptors have been vicious and depraved characters, yet their pupils have become men of merit and just estimation.

Although the observations which have gone before, may appear foreign to the present subject, yet the application of the previous principle will be obvious, when we see that the point to which it was intended to apply them, was to illustrate a similarity of virtuous feeling which existed in the mind of Aristotle, and that of his very illustrious pupil, Alexander the Great; for as the preceptor had contemplated one of the greatest and noblest schemes which finite capacity could comprehend: to write a general and detailed history of *every* production in nature, to whom was properly applicable that expression of Pliny applied to Hipparchus,—*Causus rem etiam Deo improbam*. It was, indeed, difficult, and such an aspiration as more properly appertained to a divine nature to conceive a design so gigantic, so replete with miraculous energy, to attempt to describe the entirety of what nothing short of infinite power had formed. The ancient and modern world have been much obliged by the progress which this great man actually made towards the accomplishment of his immense design; he having with his own hands dissected, or else attended to the dissection of a considerable number of rare and scarce animals, in order to remark upon the agreement of their component parts. In which design his august pupil lent the aid of his great power, having sent him, from his Persian and Indian expedition, a large variety of animals, very rare, or scarcely known in Greece.

But to conclude the comparison we proposed to make between the noble mind of the master and that of his august pupil, we proposed to remark the close assimilation between the nature and disposition of the two, and which varied only in that proportion of their respective destinies, which their several situations pointed out. Aristotle's proceedings were directed by that principle which never fails to stimulate the generous, noble, and public spirited; the

attainment of the greatest possible good for universal humanity, which his consummate abilities were well calculated to realize; defying the arduous labour and privations which the being who persevered in such a pursuit must be destined to endure. Whilst the ample mind of his pupil, conscious himself of possessing the superior ability to conquer mighty nations, and also aware of possessing talent to rule them, besides possessing the ample means to achieve these glorious ends which the valour and discipline of a large army could afford; and also knowing what his large resources could supply; and taking into consideration his love of sciences and arts: also it is here suggested, from a slight knowledge of the affections of his generous nature, that his views, although they must of necessity, in the first instance, appear sanguinary, yet they contemplated ultimately the amelioration of the human species, by rescuing them from the slavery of ignorance and idle superstition, to promote their general and individual happiness.

Had it pleased heaven to have protracted the existence of Aristotle to enable him to complete the grand design his great and comprehensive mind had contemplated, the benefits which the sciences and arts would have received therefrom, would, indeed, have been incalculable. However, what he left unperformed, the labours of succeeding ingenious men must endeavour to supply: had it pleased the dispenser of our fates to have endued us with adequate ability, we should have been happy to contribute our extremely circumscribed portion of ability to have brought his great work towards a conclusion; but since this is denied to us, even in the most limited degree, to attain to his perfection, we must be content to aspire to give the general heads of such a design, and to avail ourselves of the best labours of the most illustrious naturalists which have been presented to our knowledge, or come within the periphery of our observation. Selecting only a brief abstract of the two most celebrated systems, our limits not permitting a full or complete description. Those authorities we select come from the approved labours of Count *Charles Von Linné*, and *Thomas Pennant*, Esq.

Premising that in the very brief view we first proposed to take of natural objects, we discovered that the various beings which present themselves to human observation, a mere catalogue of their names would fill an immense number of volumes. We are truly insensible of the exact amount of the materials essentially necessary to a complete or detailed history, or even to constitute a mere descriptive nar-

rative; but from what we know, we think ourselves justified in observing, that it would occupy a man his longest period of existence alone to read. However, in conformity with our original design, we are bound to take a slight and cursory view of living and sensitive existence. For this purpose we generally stipulate, that although we remember it has been said the favourers of system are averse to any thing which is not treated in either a *synthetic* or *analytic* manner, and although we dissent from this position with respect to the necessity for such arrangements in natural history, the beings and their habits which form the subjects of the naturalist's contemplations;—because those creatures are most of them separate and distinct from each other;—but must confess the necessity of attention to the previous observation upon account of the complicated variety of the objects; without some systematic arrangement this chaos would be, indeed, inexplicable.

The term ANIMAL comes from the Latin adjective *animalis*, expressive of the attribute of *life*; it means an animated conscious existence,—a being possessed of common sensitive faculties, also of spontaneous locomotion, besides those of vegetation and generation; which two last qualities are common to vegetables as well as animals. The term undoubtedly claims a higher descent, but the previous description will answer our purpose, as it would be very easy to trace its etymology through the Greek up to the Samaritan or Hebrew.

Of animals as well as vegetables, there are also specific and grand family divisions as well as minor and peculiar distinctions to be made: thus there are found to be existing distinctions between one species of animals and others of the same class, and another, which are generally found to be regulated by the soil where they are bred, and occurs as well in point of size, as in nature and disposition; for those animals produced in a dry sunny soil, are strong and vigorous, though not luxuriant with respect to nervous energy, and sharp and fierce with regard to disposition; those, again, produced in warm and moist climates, are luxuriant, tender, and much larger than those produced in dry warm countries.

We are assured of extraordinary appearances in animals with respect to size, in the interior of Africa, and also in South America; which, to people who have never seen such, or indeed, scarcely heard of them, appears totally incredible. But it is not in all cases that the frequency of appearance, or even our actual sensations, are the just cri-

terions of truth. Sensation, indeed, often deceives us, as we have seen, with respect to natural appearances; and we may conceive that we are justified in believing sometimes those things we have not seen; and, really, taking all circumstances into consideration, here, this appears to be one of those times when we say, after others, that there are found in the interior of Africa and of America, but particularly in the latter, earth-worms a yard long, and an inch thick; serpents of monstrous size and length, as we have personally seen in the *boa constrictor*; bats as large as rabbits; toads equal in size to ducks; and spiders of equal magnitude to the English sparrow. At the same time these monstrous appearances are observed in warm and humid countries, owing to the *luxuriance of nature*, it follows, that from an opposite cause, the cold and dry sterility of nature in the cold and northern countries, most animals are scarce, and what are found, (except the *bear*, which appears to be co-natural to these inclement climes,) are much smaller than those of the same family and species in other climates, not being above half the size of those in the torrid and temperate zones.

Again, every animal from the highest to the lowest order, is furnished, by nature, with means for its own preservation, and finds security either by force or cunning, swiftness or courage: all except those animals which man has rendered domestic, and which are subservient to his necessities, or conducive to his pleasures; *those losing their natural right of freedom, have also forfeited many of their exclusive privileges of defence; and as they are entirely devoted to the service of man, they naturally look to him for support and protection.* This is the case with the sheep, the most defenceless of creatures; the cow, and numerous other domestic animals.

Animals are found to vary considerably, according to their food or climate; and there are but few of the animal creation, (those, however, are the most useful,) which are found capable to attend man in his peregrinations over the globe. In uncultivated nature, the animal kingdom far exceeds the vegetable; but in a state of improvement, the interests of men so direct it, that the vegetable exceeds the animal: for on a review of the animal and vegetable world, we find but few animals which are intrinsically serviceable to man; while, on the other hand, numbers are noxious to his food, enemies to his interest, and implacably hostile to his security and repose. But in the vegetable world, very few are noxious, the greater part

yielding either food, medicine, or some other valuable article contributive to his necessities; therefore, it always has, and will ever remain to be the interest of man, to diminish the number of animals, and increase that of vegetables; and in assistance to his endeavours Providence has, with its usual wisdom, ordered that one animal should serve as food for another; for were all animals to live entirely on vegetables, myriads would soon become extinct for want of support.

The number of animals which are immediately serviceable to man, exclusive of birds and fishes, which serve for food, does not exceed one hundred, while we are acquainted with no less than 20,000; and even this large number comprehends but a very small portion of animated nature. Not only the earth, air, and waters teem with myriads of living creatures, but also every vegetable, and almost each single leaf, is covered with an endless number of inhabitants, whose various forms and peculiar properties have afforded matter of astonishment to the microscopic observer.

One of our very ablest geologists, with that accuracy of observation which ever distinguishes the works of the scientific observer of nature, and for which his labours are peculiarly eminent, hath observed, on the formation of vegetable mould, that on every part of the earth where vegetation takes place, and where the surface remains for a long time undisturbed, a light black earth will be formed, being the carbonaceous remains of the vegetable matters which have been there annually deposited, and which have undergone the decomposing power of various succeeding seasons. In those parts where, in consequence of the melioration of the soil by winter floodings, and the genial influence of the sun's ardent rays in summer, vegetation proceeds with rapidity,—there will the production of this vegetable earth be not only more considerable, but the same circumstances will be also favourable to the formation, destruction, and reproduction of myriads of the smaller classes of animated beings, which inhabit the surface of the earth, the waters, and the vegetables themselves. The surface of the earth will, therefore, at one season be found teeming in every point with animal and vegetable life.”²

Among such a crowd of animated beings, with which we are every where surrounded, it is no wonder that naturalists should be perplexed, and indeed confused in arranging them into some general order; in consequence every differ-

² Parkinson's Organic Remains, Let. xxvi.

ent writer of note, who has treated this subject, has formed to himself some different mode of general distribution; some of whom have displayed much ingenuity, others have afforded a temporary amusement only, their systems perishing with the material on which they have been recorded.

Omitting, therefore, every different system of antiquity and even of modern times, we only, as has been suggested, propose to furnish the simple outline of two of acknowledged celebrity, that of Baron Von Linné and Mr. Pennant. Perhaps the former of these specifically may suffice.

The former of these gentlemen divides animals according to their internal structures. Some have such distinctions as follows: *i.e.* the heart has two ventricles and hot red blood; others have the heart with only one ventricle, and cold red blood, viz. fishes and amphibiæ: the former having gills, and the latter furnished with lungs. Some have the heart with one ventricle and cold white *serum*, viz. insects and worms; the former being furnished with feelers, and the latter with holders. All quadrupeds having teats are distinguished by their teeth. Those form the following *seven* orders: 1st, The primates, or principals, have four cutting teeth in each jaw; 2d, the *brutæ*, or brutes, have no cutting teeth; 3d, the *feræ*, or wild beasts, have generally six cutting teeth in each jaw; 4th, the *glires*, or dormice, have two cutting teeth, both above and below; 5th, the *pecora*, or cattle, have no cutting teeth above, and six or eight below; 6th, the *ballæ*, or beasts, properly so called, have the fore teeth blunt; and 7th, the *cetæ*, or those of the whale kind, have cartilaginous teeth.

This is the brief outline of this celebrated naturalist's arrangement; the names of which several animals, and their respective classes, occupying two large octavo volumes. The other system is that delivered by the very ingenious Pennant, and which is the most accurate that has, perhaps, ever appeared, though it comprehends quadrupeds only. Those he divides into *hoofed*, *digitated*, *pinnated*, and *winged*. 1st, the hoofed are divided into whole hoofed and cloven hoofed: 2d, the digitated are distinguished into the frugivorous, carnivorous, and insectivorous; regarding, at the same time, the number of canine teeth: 3d, the pinnated are identified by the piscivorous and herbivorous; and 4th, the winged, which includes the bats, are insectivorous.

These outlines must be confessed to be most simple, and calculated to produce the effects their authors intended. But, it seems, the following has been considered the most natural division of animated nature; which admits of distinction into the five following classes.

1st, Quadrupeds; 2d, birds; 3d, fishes; 4th, insects; and 5th, amphibious animals; to which, perhaps, a sixth may with propriety be added, *i. e.* bipeds: though it really appears that this distinction is not exactly defined by nature, for to follow her distinctions, nothing is more difficult; as there are numerous classes of animals whose forms and qualities render it almost impossible to reduce them to any one of these formulæ.

Linnæan Classification.

CLASS I.—MAMMALIA. This class includes all animals that suckle their young:—the characters are these; the heart has two ventricles, two auricles—blood red and warm; and the animals are viviparous.

This CLASS consists of *seven* orders, the distinct characters are taken from the number and structure of their teeth, *i. e.*

Order 1.—*Primates*, which have four *incisores*, or fore-teeth in each jaw, and one dog-tooth on each side of the fore-teeth in each jaw. This order includes four *genera*, *i. e.* *homo*, *simia*, *lemur*, and *vespertillo*.

Order 2.—*Brutæ*, which have no fore-teeth in either jaw. This order includes seven genera; *i. e.* *rhinocerus*, *elephas*, *trichechus*, *bradypus*, *myrmecophaga*, *manis*, and *dasypus*.

Order 3.—*Feræ* have for the most part six conical teeth in each jaw. This order includes ten genera, *i. e.* *phoca*, *canis*, *felis*, *viverra*, *mustela*, *ursus*, *didelphis*, *talpa*, *sorex*, and *erinaceus*.

Order 4.—*Glires* have two fore-teeth in each jaw, and no dog-teeth. This order includes ten genera, *i. e.* *hystrix*, *lepus*, *castor*, *mus*, *sciurus*, *myoxus*, *cavia*, *arotomys*, *dypus*, and *hyrox*.

Order 5.—*Pecora* have no fore teeth in the upper jaw, and but six or eight in the lower jaw. This order includes eight genera, *i. e.* *camelus*, *moschos*, *giraffa*, *cervus*, *antelope*, *capra*, *ovis*, and *bos*.

Order 6.—*Belluæ* have obtuse fore-teeth in each jaw. This order includes four genera, *i. e.* *equus*, *hippopotamus*, *sus*, and *tapir*.

Order 7.—*Cetæ*, or whales, have no character in their teeth; being very different in the different genera: but each is sufficiently distinguished from other orders of this class by living in the ocean, having pectoral fins and fistula, or spiraculum, upon the head. This order contains four genera, *i. e.* *monodon*, *balæna*, *physeter*, and *delphinus*.

General Observations.—Besides the several generic cha-

acters of this class, taken from the teeth, some of the genera have other distinguishing marks, *ex. gra.* The *vespertilio* has a membrane attached to its feet and sides, by which it is enabled to fly; thus uniting the pinnated and the quadruped links of the chain of creation. The *hystrix* is covered with sharp spines; and the whole order of *pecora* are distinguished by having, or else being destitute of horns, and by peculiarities in the horns themselves.

The specific characters of the different genera and species are very various, and taken from many parts of the body which possess some peculiar mark of distinction.

CLASS II.—AVES, or birds. The characters of this class are nearly the same with Class I. except that these animals are *oviparous*. This class is divided into six orders: their characters being chiefly taken from the structure of the bill.

Order 1.—*Accipitres* have a hooked bill, the superior mandible near the base being extended to each side beyond the inferior one; and in some of its species it is armed with teeth. This order contains four species, *i. e.* vulture, falco, stryx, and lanius.

Order 2.—*Picæ*, or pies, have a convex compressed bill, resembling a knife. The whole order contains twenty-three genera, *i. e.* trochilus, certhia, upupa, glaucopsis, buphaga, sitta, oriolus, coracias, gracula, corvus, paradisea, ramphastos, trogon, psittacus, crotophaga, picus, yunx, cuculus, bucco, boceros, alcedo, merops, and todus.

Order 3.—*Anseres*, have a smooth bill, broadest at the point, and furnished with teeth: the tongue is fleshy, and the toes are palmated or webbed. This order includes thirteen genera, *i. e.* anas, mergus, phæton, plotus, rhincops, diomedea, aptenodyta, alca, procellaria, pelecanus, larus, sterna, and colymbus.

Order 4.—The *Grallæ*, which have a somewhat cylindrical bill, a short tail, and naked thighs. This order includes twenty genera, *i. e.* phænicopterus, platalea, palamedea, mycleria, tantalus, ardea, corriera, recurvirostra, scolopax, tringa, fulica, parra, rallus, vaginalis, psophia, cancruma, scopus, glareola, hæmatopus, and charadrius.

Order 5.—*Gallinæ*, which have a convex bill, the superior mandible vaulted over the inferior one, the nostrils half covered with a convex cartilaginous membrane, and the feet divided, but connected at the innermost joint. This order contains ten genera, *i. e.* otis, struthio, didus, pavo, meleagris, penelope, crax, phasianus, numida, and tetrao.

Order 6.—*Passeres*, distinguished by a sharp-pointed

bill, the nostrils oval, wide, and naked. This order contains seventeen genera, *i. e.* *loxia*, *coluis*, *fringilla*, *phyloloma*, *emberiza*, *camprinulgus*, *hirundo*, *pipra*, *hudus*, *ampelis*, *tanagra*, *mucicapa*, *parus*, *motacilla*, *alanda*, *sternus*, and *columba*.

Observations.—The generic characters of this class are taken from peculiarities in the bill, the nostrils, the tongue, the feet, the feathers, the face, the figure of the body, &c.

General Observations.—The characters which serve to distinguish the species are various: *ex. gra.* the colour of the particular feathers, or parts of feathers; crests, or feathers on the head, disposed in different directions; the colour of the *cera*, or wax; colour of the feet, the shape and length of the tail, the number situation, &c. of the toes, the colours and figure of the bill, &c.

CLASS III.—AMPHIBIA,—distinguished into two orders.

Order 1.—*Reptiles*, have four feet, and breathe by the mouth: this order has four genera, *i. e.* *testudo*, *draco*, *lacuxta*, and *rana*.

Order 2.—*Serpens, vel draconis*, have no legs, and breathe by the mouth. This order contains six genera, *i. e.* *cro-talus*, *boa*, *coluber*, *unguis*, *amphisbæna*, and *cæcilia*.

Observations.—The generic characters of this class are taken from the general figure of the body, from their having tails, or no tails, being covered with a shell, having teeth, furnished with lungs; having covered or naked bodies; from the number, situation, &c. of the scuta and scales; from the number and situation of the spiracula; the situation of the mouth, &c.

General Observation.—The specific characters are so various, that it would be endless to enumerate them.

CLASS IV.—PISCES,—is divided into six orders; the characters taken from the belly-fins.

Order 1.—*Apodes*, have no belly-fins. This order contains ten genera, *i. e.* *petromyzon*, *muræna*, *gymnotus*, *trichurus*, *anarchicas*, *ammodytes*, *stromateus*, *xiphias*, *stemaptix*, and *leptocephalus*.

Order 2.—*Jugulares*, have belly-fins placed before the pectoral fins. This order includes six genera, *i. e.* *callionymus*, *uranoscopus*, *pactinus*, *gadus*, *blennius*, and *kurtus*.

Order 3.—*Thoracicii*, have belly-fins placed under the pectoral fins. This order comprehends nineteen genera, *i. e.* *cepola*, *echeneis*, *corcyphæna*, *gabius*, *cottus*, *scorphanæa*, *zeus*, *pleuronectus*, *chætodon*, *sparus*, *scarus*, *labrus*, *sciænæa*, *percæ*, *gasterosteus*, *scomba*, *centrogastes*, *mullus*, and *trigia*.

Order 4.—*Abdominales*, have the belly-fins placed behind the pectoral fins. This order includes sixteen genera, *i. e.* *cobitis*, *amia*, *silurus*, *tenthis*, *loricaria*, *salmo*, *fistularia*, *esox*, *elops*, *argentina*, *atherina*, *mugil*, *exocaetus*, *polynemus*, *clupea*, and *cypinus*.

Order 5.—*Branchiostegi*, have the gills destitute of bony rays. This order contains ten genera, *i. e.* *mormyans*, *astracion*, *tetrodon*, *diodon*, *syngathus*, *pegasus*, *centriscus*, *balistes*, *cyclopterus*, and *lophius*.

Order 6.—*Chondropterygii*, have cartilaginous gills. This order contains five genera, *i. e.* *acipenser*, *chinæra*, *squalus*, *raia*, and *petromyzon*.

General Observation.—The generic characters of this class of animals are taken from some peculiarities in the head, mouth, teeth, nostrils, rays, &c.; in the membranes of the gills; eyes, general figure, form of the tail, situation of the spiracula, &c.

The specific characters are taken from some peculiarities in certain of the above-mentioned parts.

CLASS V.—INSECTA—is subdivided into seven orders; the characters of which are taken from the wings.

Order 1.—*Cleoptra*, have four wings, the two superior ones being crustaceous, and furnished with a straight stricture. This order contains fifty-five genera, *i. e.* *scarabæus*, *lucanus*, *dermestes*, *melyris*, *lyrrhus*, *silpha*, *tritoma*, *hydrophilus*, *hister*, *pausus*, *leos*, *trichus*, *anthrelus*, *nitidula*, *cocinella*, *brentus*, *altelabus*, *crodius*, *staphylinus*, *scaurus*, *zygra*, *meloe*, *tenebrio*, *cassida*, *opatrum*, *mordella*, *chryso-mea*, *horia*, *apalus*, *manticora*, *pimelia*, *gyrinus*, *cucujus*, *cryptocephalus*, *bructus*, *ptinus*, *hispa*, *buprestis*, *necydalis*, *lampyris*, *cantharis*, *notoxus*, *elater*, *calopus*, *alurnus*, *carabus*, *lytta*, *serrophalus*, *cerambyx*, *leptura*, *rhynomacer*, *zonitis*, *cicendela*, *dyticus*, and *forficula*.

Order 2.—*Hemiptera*, have four wings, the two superior ones being semi-crustaceous and incumbent, *i. e.* the interior edges lie one upon another. This order includes fourteen genera, *i. e.* *blatta*, *pneumora*, *mantis*, *gryllus*, *fulgoræ*, *cicadæ*, *notonecta*, *nepæ*, *cimex*, *macrocephalus*, *aphis*, *chermes*, *coccus*, and *thrips*.

Order 3.—*Lepidoptera*, possess four wings, all of them imbricated with scales. This order contains three genera, *i. e.* *papillo*, *sphinx*, and *phalæna*.

Order 4.—*Neuroptera*, have four wings interwoven with veins, like a piece of net-work, and no sting in the anus. This order contains seven genera, *i. e.* *libella*, *ephemera*, *hemerobius*, *mirynilion*, *phryganea*, *panupa*, and *rophiidia*.

Order 5.—*Hymenoptera*, have the same characters with the former, only the anus is armed with a sting; but this mark is peculiar to the females and the males, for the males have no sting. This order includes fifteen genera, *i.e.* *cymps*, *tentredo*, *sorex*, *ichneumon*, *scolia*, *thynnus*, *leucospis*, *tiphia*, *chalsis*, *chrysis*, *vespa*, *apis*, *fornica*, and *mutilla*.

Order 6.—*Diptera*, have two wings, and two clavated halteres or balances beneath each wing. It comprehends twelve genera, *i.e.* *diospis*, *tipula*, *musea*, *tabanus*, *empis*, *conops*, *ocstrus*, *ausilus*, *stomorys*, *culex*, *bombylius*, and *hypobosca*.

Order 7.—*Aptera*, have no wings. This order contains fifteen genera, *i.e.* *limpisma*, *podura*, *termes*, *pediculus*, *pulex*, *acarus*, *hydrachanna*, *aranaea*, *phalangium*, *scorpio*, *cancer*, *monocus*, *oniscus*, *scolependra*, and *julus*.

CLASS VI.—VERMES,—divided into five orders.

Order 1.—*Intestina*, are the most simple animals, being perfectly naked, and without limbs of any kind. This order contains twenty-one genera, *i.e.* *ascaris*, *tricocephalus*, *uncinaria*, *tilaria*, *scolex*, *ligula*, *lingulatala*, *strongylus*, *echinorinchysichus*, *hæruca*, *cuncullanus*, *caryophyllacus*, *fasciula*, *tænia*, *furia*, *myxini*, *gordius*, *hirudo*, *lumbricus*, *sipunculus*, and *planeria*.

Order 2.—*Mollusca*, are likewise simple naked animals, without any shell, but they are brachiated, or furnished with a kind of limbs. This order contains thirty-one genera, *i.e.* *actinia*, *clava*, *mammaria*, *pedicellaria*, *ascidia*, *salpa*, *dagysa*, *plerotrachea*, *clio*, *lobaria*, *lernæa*, *scyllæa*, *glacus*, *aphrodita*, *amphitrite*, *spio*, *nereis*, *pysophora*, *medusa*, *lucemaria*, *asterius*, and *echinus*.

Order 3.—*Testacea*, have the same characters as those of Order 2, but are covered with a shell. This order includes thirty-six genera, *i.e.* *chilton*, *lepas*, *pholas*, *mya*, *solen*, *tellina*, *cardium*, *mactra*, *donax*, *venus*, *spondylus*, *chæma*, *arca*, *astera*, *anomia*, *mytilus*, *pinna*, *argonauta*, *nautilus*, *conus*, *cypræa*, *bulla*, *voluta*, *baccimum*, *strombus*, *murex*, *trochus*, *turbo*, *helix*, *nerita*, *haliotis*, *patella*, *dentatium*, *serpula*, *teredo*, and *sabella*.

Order 4.—*Zoophytra*, are compound animals furnished with a kind of flowers, and having a vegetable root and stem. This order contains fifteen genera, *i.e.* *tubipora*, *madrepora*, *millepora*, *cellepora*, *isis*, *antipathes*, *gorgonia*, *alcyonium*, *spongia*, *flustra*, *tulbularia*, *corralina*, *sectularia*, *pennatula*, and *hydra*.

Observation.—Zoophytes are a class of animals serving as a link in the chain of animated nature, for connecting

organized animal existence with vegetative life; serving fully to convince us of the truth of the relation of *Diodorus Siculus*, which we have always doubted, when that author describes some apparently miraculous mice of Thebes in Egypt; but his relation being meant by that authority to reconcile his conception of the first of living creatures having sprung from the earth in the crustaceous form of bubbles.— See *lib. iv. cap. 1.*

Order 5. — *Infuriosa* consist of very small simple animals. This order contains fifteen genera, *i. e.* *brachionus*, *vorticella*, *tricholda*, *cercaria*, *leucopera*, *gonium*, *colpoda*, *paramecium*, *cyclidium*, *burasaria*, *vibrio*, *enchelis*, *bracillaria*, *volvox*, and *monas*.

The chief parts which constitute animal nature are as follow:—

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| 1. Bones and shells, | 7. Glands, |
| 2. Horns and nails, | 8. Brain and nerves, |
| 3. Muscles and skin, | 9. Hair and feathers, |
| 5. Membranes, | 10. Silk, fur, down, and similar bodies. |
| 6. Tendons and ligaments, | |

The preceding relate to the exterior, or most obvious parts of animal existence, whilst the interior, and more concealed parts of an animal are as follow:—

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| 1. Milk, | 8. Liquor of the pericardium, |
| 2. Eggs, | 9. Humours of the eye, |
| 3. Saliva, | 10. Mucus of the nose, |
| 4. Pancreatic juice, | 11. Sinoria, |
| 5. Bile, | 12. Semen, |
| 6. Cerumen, | 13. Liquor of the amnios, |
| 7. Tears, | 14. Poisonous secretions. |

There are, besides, various substances separated either from the blood or food, on purpose to be afterwards thrown out of the body, as useless or hurtful. These are called excretions; the most important are,

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| 1. Urine, | 2. Fæces. |
|-----------|-----------|

Besides the liquors secreted for different purposes by healthy animals, there are others which make their appearance only during disease, and are therefore called morbid secretions: the most important are

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|---------|----------------------|------------------------|
| 1. Pus, | 2. Liquor of dropsy, | 3. Liquor of blisters. |
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To these may be added, several solid bodies which are

occasionally found in different cavities, in consequence of the diseased action of the parts, and may be called morbid secretions.

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| 1. Salivary calculi, | 4. Internal calculi, |
| 2. Concretions in lungs or liver, brain, &c. | 5. Urinary calculi, |
| 3. Intestinary calculi, | 6. Gouty calculi. |

There are, also, occasionally transmutations or radical changes of the parts, from disease of some particular organs, which may be called, perhaps, morbid affections of those parts so suffering.

These are ossifications of the vital parts; the brain, but more generally of the heart.

Likewise, there are other substances the produce of disease discovered; when the proper economy of nature is perverted, the blood is not sometimes formed as is usual, then the liquid which was to be so dispersed becomes *ichor*, which oftentimes assumes a morbid appearance on various parts of the body; these are sometimes vulgarly called *wens*, when in fact they are only mere *ichorous* tumours.

Before we quit the animal kingdom, it may not, we hope, be thought impertinent to remark, that the faculty termed *instinct* in animals, is an appellation given to the sagacity of certain of many species, and said to be attributable to the natural inclination of many of the brute creation; may be instanced in the dog, horse, elephant, and many others,—answering the purpose of reason in man.

COLD.—The cause of cold has been a question among philosophers; some have not distinguished properly between the effect and its cause, who have alleged that it is only the absence of heat. Others have gone farther, and asserted that it is a real substance. The *cause* appears to have been discovered in its effects; for it is observed, that at a certain distance below ground where there is a free circulation of internal air admitted, the effect of cold is unknown; which appears to convince us, that it exists in the exterior atmospheric air alone. This conjecture is confirmed from observations made upon the effects of cold when water is exposed to the air; and in motion it being observed to freeze much sooner than that which is sheltered from aerial effects and in perfect quiescence; also from observations made repeatedly in subterrestrial situations, where a free circulation of exterior atmospheric air is excluded, the power of frigidity is unknown; but we have an instance to adduce in the very local

situation where cold is most felt, in a fact recorded by an author to whom our obligations have been often due. M. P. J. Von Strahlenberg, in his *Historio-geographical Description of the North and North-eastern parts of Asia and Europe*, has thus described the effects he experienced in a cave in *Siberia*.

“ In the year 1722, in the month of February, going in a sledge on the river Jenisei, I observed such a cave,” as he had previously described, “ between the two cities of *Abakan* and *Crasnoyahr*. The banks of the river are in this place a steep rock as high as any church-steeple, in the middle of which there appeared an opening about forty fathoms above the surface of the water. The entrance into this cave is about five fathoms wide, and near fifteen fathoms in height. I went into this place, and advanced upwards into the rock as far as I could conveniently, I think about thirty fathoms; but finding the passage darker, and notwithstanding it was in the depth of winter, and that day being besides a terribly cold one, there came from this cavity so warm a vapour that it made me sweat, and discouraged me as well as my fellow traveller from venturing any further. We had a great deal of trouble to come at the entrance from the bottom; for this rock is very steep, and was at that time covered near six feet thick with snow, which being pretty compact, was the only means by which we could get up by fixing our feet into it: however, we could not help sliding sometimes a good way down again. The Swedish boy, whom I have had occasion to mention above, was with me in this place, and he with the Tartar who drove the sledge, both advanced higher, almost to the top of the rock; where they met with another opening, within which they found several pieces of old household goods, and this gave us room to believe, that formerly it must have been inhabited. This confirmed the opinion which myself and fellow traveller, who was a Russian dragoon,” (our author was a prisoner of war), “ conceived when we were in the cave, viz. that there must be a communication between the opening we entered and some other cavity; because, smoking a pipe whilst we were in it, we did not perceive that the smoke came back towards the entrance of the cave. That which I thought most observable in that part of the cave I was in, (besides some dead birds, such as that sort which the Germans call *silk-tails*, in Latin, *garrulus Bohe-micus*, and two kinds of bats with long and narrow ears,) was a vast number of icicles about the top of the entrance, formed by the concourse of the warm vapours from within

and the external cold without. These icicles were not round, but hexangular, pretty long, and tapering to a point."—Cap. xiii. p. 34, *ubi supra*.

Hence it certainly does appear, as well from what we have seen, and also considering that spring-water, in the bowels of the earth, is never known to freeze, but retains the same uniform temperature in summer and in winter, that *cold* exists alone in the atmospheric air. Besides, we have the authority of the learned Dr. ADAM, the highly respected rector of the High School of *Edinburgh*, who uses this precise expression: "*Two inseparable qualities of air are HEAT and COLD.*"—p. 48 of his Summary. Monitorial dictates, are, by the bye, unnecessary, for every day's experience informs our senses of this fact.

Another apparent quality of heat and cold upon the atmosphere is, that heat dilates and expands the atmospheric air, whilst cold produces a reverse effect, as may be ascertained from the station of the mercury in a thermometer. The freezing point of Fahrenheit is 31° , whilst the temperature is 52° , and boiling heat 73° . The heat of a common spring is 35° . Thus we may discover the proportionate manner in which mercury is affected by the change of temperature, being a difference of 21° between freezing and temperate, also 21° between temperate and summer heat; and no less than 42° between both extremes. Yet we have not looked to the cause, but can proceed one step higher to regard the effect; and submit, from what we know, that the effect by cold upon the airy corpuscles is, as we have seen, to produce evanescence upon the airy particles, and being so compressed in point of size the particles more readily enter all porous substances; among these our flesh is one of that nature. The effect is similar with respect to the admission of aerial corpuscles upon all bodies whatever,—iron, wood, stones, &c. which are all visibly, we had nearly said, sensibly affected, as may be perceived upon a sudden change from heat to cold, or from cold to heat; such substances often being seen to break in many directions, which of course is occasioned by their imbibing a larger number of aerial particles when air is so circumstanced, than they would do if in another situation. A person so pierced with those particles; we will suppose, hastens to a fire, with intention to alleviate the sufferings he endures from the intrusion of so uncongenial an inmate: the part presented to the action of the fire presently will be found to endure a much more intense degree of pain, than that from which it sought to be relieved, which is occasioned, evidently, by the sudden

effect of the rarefying power of the fire upon the particles of air within the flesh, or at least beneath the skin, causing them to swell to so great a degree, as almost to occasion the destruction of the parts. Upon exposing the recently distended parts to the influence of cold a second time, we may then discover, that from the recent distension, the cold, which at first affected us only superficially, penetrates much further, affecting the blood, marrow, and other juices, and producing those diseases so afflicting, and often fatal, to the being of delicate individuals.

We have not yet caught a glance of the first cause of cold; should we presume to suggest the most *probable view* in our opinion, we hope for that liberality from others we are conscious of having experienced when speaking of the hypothesis of any individual whomsoever.

Aeronauts have experienced extreme cold when they have arisen at a point superior to common atmospheric influence, when we may presume they have ascended into pure air, or ætherial space; why, therefore, may not the piercing influence of extreme cold be produced by the ætherial matter having assumed, and occupying for the time, the place of atmospheric air. This disposition of the air is, we perceive, uncongenial to the lungs, producing, upon inhalation, a considerable degree of irritation of that member; of which those affected by colds, coughs, and all pulmonary complaints are most sensible. Heat, upon this globe, is acknowledged to exist, in consequence of the reflexion of the solar rays upon such objects it meets with; and is either increased or diminished, proportionate to the squares of the surface upon which it falls; whence may be accounted for, in part, the cause why it is not found to be so hot on the very apex of an high mountain, when we may be much nearer to the sun, as it is upon its side where the solar beams are reflected.

Whence also is the cause of the intolerable heat of the rays of a vertical sun upon the almost boundless deserts of *Lybia*; those deserts being chiefly composed of minute siliceous particles, the rays are reflected in every possible direction; and also those sands have the property to retain the heat to so great a degree, that a sufficient space is not allowed between the vertical ray of one day to that of another day to suffer them to cool. Under this impression, then, we submit that the cause of cold is the exchange of our grosser terrestrial exhalations for purer ætherial matter.

As the health of nature is found to consist in the motion of its parts, so heat and cold are to be viewed as causes to

produce this desirable effect, occasioning alternate exchanges of the atmospheric particles for those purely æthærial; this motion in the change also accounts for another surprising phænomenon, it being observed that at the instant before freezing commences the mercury will instantly rise a little, but quickly sinks again.

We have not yet arrived at the proximate and original cause of the reciprocal exchange of situation in the æthærial and atmospheric particles; to account for which, we are not ashamed to confess our inability, but leave that discovery to some more happily speculative theorist.

CONGEALATION.—When fluids are changed by cold into a solid state, it is called *congealation*, or freezing.

The instrument used to measure the different degrees of heat and cold in the atmosphere by means of its elastic and expansive power, and which effect determines those states, is called a *Thermometer*; the invention of which has been attributed to many eminent persons. Air, æther, and spirit of wine, were first used for this purpose, by Ferdinand II. Grand Duke of Tuscany, or by the members of the academy *Del Cimento*, under his protection. *Boyle* first introduced the thermometer into England.

The fluid now generally used for this purpose is quick-silver, as being more uniformly heated, or cooled, than any other known fluid; and which, till lately, was thought could not be congealed by cold.

Thermometers are adjusted to a boiling and freezing point, according to the method proposed by *Fahrenheit*, a celebrated artist of Amsterdam. Those points were not ascertained without considerable difficulty, much labour, and very accurate observation by the ablest philosophers.

Different degrees of cold are requisite for the congealation of various fluids. Water congeals when Fahrenheit's thermometer stands at 32° above 0, as we have seen; vinegar at 28° ; wine at 20° to 34° ; and brandy at 7° below 0. Light spirit of wine at 34° below 0; and mercury itself, it is thought, at 48° below 0, a degree of cold, of which, in this country, we have no conception.

The action of congealation is always instantaneous. Although all known substances, and water among the rest, are considerably diminished in bulk by cold; yet after water is arrived at the freezing point, the congealation which then instantly takes place, makes it suddenly expand about one ninth of its bulk, which is discovered to be owing to an

innumerable quantity of particles of aerial bubbles, with which ice is filled. Hence ice is lighter than its bulk of water, being as eight to nine; it therefore floats upon its surface.

Water is more easily frozen after it has been boiled; and more so when a little moved than when quite at rest. It has been considered strange, that water in the act of freezing should become a little warmer, the mercury in the thermometer being sensibly affected upon immersion, but instantly recovers its position: this may have been just now accounted for.

Water mixed with salt, or melted snow, or ice, will not freeze till the thermometer is considerably below 32° ; but if a glass of water be immersed in this mixture, it will immediately freeze.

Various causes have been assigned for frost, or congelation; but it seems, that most of them are liable to some objections.

The power of air is here also confessed in the strongest manner possible; for it must be owing to its intrusion into the liquid element, in uncommon large portions, that ice in congelation is found to swell; and so instantaneous is the effect, that it will burst the strongest cannon. We hope we may have, in part, suggested the mode of this operation in the last *article*: but to this cause, the stones in a pavement, or building, have been said to be loosened after a severe frost.

The ice in northern countries is considerably harder than in more temperate climes. In 1740, a palace was built of ice at St. Petersburg, thirty-two feet long by twenty feet high. Even cannons were made of it, from one of which a ball was discharged, which went through an oak plank, two inches thick, at a distance of sixty paces, without bursting the piece by explosion.

Frost is observed to proceed from the upper part of bodies, downwards, another confirmation of the truth of our theory; the exact depth it descends into earth or water is uncertain;—generally observed not to extend to more than two feet in the former, and about six feet into the latter.

Artificial ice is made of pulverised ice, or snow, mixed in certain proportions with sal ammoniac.

In the East Indies, between $23\frac{1}{2}$ and $25\frac{1}{2}$ degrees N. lat. where natural ice is scarcely ever found, artificial ice is produced, simply, by the effect of the air upon water, having slight pits sunk in a particular position, a little

below the terrestrial surface ; and by means of a solution of nitre and water.

In the act of congelation, ice assumes certain geometrical forms, but chiefly of the structure of the prism, and sometimes triangular, something like a pyramid or obelisk, or in lenticular crystals ; but generally running into extreme sharp points, in almost all directions, from its very formation, serving to convince us of the instantaneous action of cold. It generally happens that the whole length and breadth of a sheet of water is not frozen all over at once, there being generally some side shaded from the operation of the air more than others, which escapes the freezing power. However, the part left open, by degrees, admits the subtle particles of æther, the action of which still adds to the thickness of the ice already formed ; being often found in separate laminæ, of great congregated thickness.

However, amongst all the variously beneficial effects of heat and cold upon the atmosphere, one of the most important is the effect produced in *winds*, occasioned by an agitation of the air, and produced chiefly by the variations of heat and cold ; by the former of which it is rarefied, by the latter condensed. *Pliny* has said, *Ventus nihil aliud quam fluxus æris, &c.* ii. 44. So *Seneca*, *Ventus est aer fluens*, *Nat. Q.* v. 1. And, likewise, *Cicero*, in *De Nat. D.* ii. 39.

The air, being a fluid, is consequently subject to those laws which regulate fluids ; one of which is, constantly to preserve its equilibrium. It is also discovered to be subject to some other particular regulations, directed by the properties of heat and cold ; so that if any portion of aerial matter has been rarefied by heat, it will ascend, and then the *fluid* nature of air is found to operate ; other particles rush into the vacuity just made by that which has experienced the influence of heat. Thus the air is constantly carried from the polar regions to the torrid zone, where it is also affected in its turn ; this is the daily practice, following the sun from east to west. The winds, therefore, for above thirty degrees on each side the Equator, are thus affected. However, upon the surface of the globe there are observed divers winds, which are thus denominated : *perennial*, or constant winds ; *stated* or *periodical*, *variable* or *uncertain*, also *general* and *particular* ; all may be specifically defined as follows.

Perennial, are uniform and constant winds, always blowing the same way ; as the *trade*, or *tropical* winds, blow continually from east to west.

Stated or Periodical Winds, are such as return at certain times; such are the sea and land breezes, blowing from sea to land in the evening, and from land to sea in the morning. Such, also, are the shifting, or particular trade winds, which for certain months in the year blow one way, and for certain other months blow in the contrary direction. And, also, such are the winds which in one portion of the year blow from the arctic region into tropical climates, for about six weeks only, and chiefly before the summer equinox, they blow from north to south; and, then for a similar space of time their motion is from the antarctic to the tropic. Those two winds in *Egyptian hieroglyphical* expressions, are considered to be analogous to a hawk and a whoop, and so named; the one represented by the figure of a hawk, and the other of a *whoop*, or *pewet*, it being found to be customary for those birds actually to take their flight in these respective directions at this particular season; the hawk, as we find expressed in *Job*, for the purpose of changing her feathers, leaves the northern skies for a warmer climate; so also the whoop leaves its usual haunts in Nubia and Ethiopia, to follow the course of the Nile, as the waters subside, for the purpose of feeding upon such animalculæ that are found plentifully in the mud and slime left by that river. To resume our subject:—there are also *variable or erratic* winds, which blow now this way and then that way,—are now hushed, presently raging, without any rule or regularity as to time or place; such are the winds which in the inland parts of this kingdom are observed, although, sometimes, several of these claim certain periods of the day or night. Thus the east wind is most frequent at noon, the south wind in the night, and the north wind in the morning, &c.

Particular Winds, include all others, except the *general trade winds*; those particular to any canton or province have been called *tropical* or *provincial*; such is the north wind on the western side of the Alps, which does not blow above one or two leagues in length, and much less in breadth; such also is the *Portias* in France, &c.

Physical Cause of Winds.—Passing by the opinions of *Descartes* and *Rohault*, with others, as inefficient to our present purpose, we embrace those of our very ingenious and indefatigable experimentalist and countryman, *Dr. HALLEY*, who, more agreeable to nature, and in our belief to probability, ascribes the cause to certain known and already ascertained laws upon aqueous vapour and air; the power of solar influence upon these, and, in fact, whilst

every part of the globe is under the influence of the sun, his supremacy is visibly apparent.

According to the law of statics, or that doctrine of gravitation by which aerial fluids are governed, the air which is less rarefied or expanded, will have motion towards those parts thereof, which are more rarefied and less ponderous, to bring it to an equilibrium: the presence of the sun shifting perpetually to westward, that part to which the air tends by reason of refraction made by his greatest meridional heat, also follows his course to westward;—consequently the whole tendency of the entire body of lower air is inclined to that direction. Thus a *general* EASTERLY wind is formed, which being impressed upon the air of a vast ocean, the parts impelled one upon another, *ad infinitum*, and are so kept moving till the next return of the sun, whereby so much of the motion as was lost by the absence of his influence, is again restored, and the easterly winds made *perpetual*.

From the same principle, it will follow, that this easterly wind should on the south side of the equator incline to the northwards of the west, and in north latitudes to the southwards thereof, or rather to the ecliptic: for near the line, the air is much more rarefied than it is at a greater distance from it, because the sun twice in a year is *vertical* upon the line, and at no time above $23\frac{1}{2}$ degrees from the equator, at which distance the cause of heat being at the sine of the angle of incidence, is little short, in effect, from that of a perpendicular ray; whereas, under the tropics, though the sun stay, yet he is a long time 47 degrees off, which is a kind of winter. Whensoever the air so cools, or that the summer heat cannot warm it to the same degree as that under the equator, it follows, that on both sides of the equator, it will be found to bend towards the equator; this motion, compounded with the formerly described easterly wind, accounts for the phenomena of all the GENERAL TRADE WINDS: which, if all the surface of the globe was an entire sea, would invariably blow quite round the world, as they are now found to do on the Atlantic and Ethiopic oceans. But, seeing so great continents to intervene, and break the continuity of the oceans, regard must be had to the nature of the soil, and the position of high mountains, two principal causes of the variation of winds from the former general rule: if a country lying near the sea prove to be sandy low land, as the deserts of *Lybia* are usually reported to be, the heat occasioned by the sun's beams, and the retention thereof by the sand, is, as has been said, incredible to those who have not felt it;

whereby the air being extremely rarefied, it is necessary that the more cool and dense air should run there to preserve the equilibrium.

The current air pressing upon the hot and rarefied column of air, demonstrates that there must be room for its reception; consequently, that air, the recently heated, must, from another well known law of nature, have ascended into a higher station in one continued stream; and as fast as it rarefies, that, having ascended, it disperses to preserve the equilibrium by a constant current; as the upper air must move from those parts where the greatest heat is, so by a species of equable evolution the vacuum, occasioned by the absence of air in one place, will be continually supplied by its superabundance in another, moving in currents with great velocity; thus a south-east wind below the equator, and a north-east wind above it, may be produced; and it is so, with respect to the other currents, that air constantly tends to that part where there is room for its reception, as water constantly finds its own level.

That this is not mere conjecture, the almost instantaneous changes of the winds to opposite points, frequently found on crossing the tropics, and the trade winds, seem to assure us; but what confirms the persuasion is, the MONSOONS³ by this means are easily solved, without it, inexplicable.

Such is the theory of Dr. Halley, whose opinion we prefer to any which is to be elsewhere found, because he spoke from actual experience.

Since the previous article on Astronomy was written, we have come to the knowledge of a circumstance, which may be, perhaps, believed to throw a new light upon that most ancient science, as well, also, as upon the national antiquity of many European and Asiatic nations; and because we would withhold nothing which, in our humble judgment, may be of importance, we subjoin, by way of postscript to that article, the following relation.

M. Bailly, a learned Frenchman, who lived at the period of the Robespierrean faction, in the possession of ample and well-earned fame, had written a History of Astronomy.

It seems, this learned, scientific, and virtuous man, was murdered during the tyranny of that arch-homicide, the sanguinary Robespierre, who emulating demoniac and dia-

³ Monsoons are periodical winds blowing in the eastern sea, nearly alternately, for somewhere about half a year each way; and generally accompanied by immense falls of rain.

bolical fury, by his actions declared himself the enemy to all that was wise or virtuous; he, therefore, extirpated all talent, wisdom, and virtue; among others, the possessors of these, M. Bailly fell a victim.

He had traced the history of astronomy from the most ancient days of the Chaldæans, through the Egyptian, Chinese, Phœnicians, Greeks, and other ancient people, down to modern times. Yet this intelligent author was constrained to confess, that from the researches he had made upon this subject, he was led to conclude that the knowledge common to all these people had been derived from the same original source, a highly cultivated people of Asia, of whose memory, he says, *every trace is now extinct*, but who have been the parent instructors of all around them. The situation of this ancient people he conjectures to have been in *Siberia*, about the 50° of north latitude. Among various other coincidences, he is found to remark that many of the Asiatic and European nations attribute their origin to that quarter, where the civil and religious rites common to each people were probably first formed.

In corroboration of his testimony, we also cite the History of Astronomy of the Rev. Mr. Costard, who, when speaking of the astronomy among the Chinese, thus expresses himself. "When the Jesuits tell us that the *Lamas*, or priests of *Thibet*, have many ancient books of history and astronomy, and that they mention the transaction of building the tower of *Babel*;" also adding, "we may safely conclude them, I believe, to be ill-grounded reports, and not to be easily credited."—Page 33.

In addition to these reports of those people, we also add, upon the credit of *Philip John Von Strahlenberg*, that he found in the Tartarian districts, besides many accurate remains of eastern languages, those of the *Hungarian*, *Goth*, *Celtic*, ancient *British*, and other tongues, with which he could have filled a large folio volume." Vide his preface, p. iv.

He also adds, in another place in the preface, some remarks of the celebrated *Leibnitz* to this effect; who regretted that "Europeans did not possess a competent knowledge of the languages of northern Asia, for the purpose of ascertaining *facts relative to the migration of nations*."

In describing a large map, which *Von Strahlenberg* had published of the Russian empire, he says, that the northern part of Asia in particular contains many places which are still unknown, and where there are monuments which the historical account so long wished for might discover to us

with great certainty: although the raw and unpolished people there have no knowledge of their signification, and are much less in a state to publish any thing concerning them. In another place, page 16 of his work, he ascribes the ignorance of the present inhabitants to its proper cause,—the destructive depopulation produced by the constant warfare among the Tartarian tribes who inhabit those districts.

In a note upon this passage, he says, “ In the year 1720, when some Russian regiments went from the city of *Tobolsky* up the river *Irtisch*, they found there many antiquities and temples of idols; and I have been told by the *Tobolskian Tartars* and Russians, that from this river farther towards the west, south, and south-west from the city of *Tobolsky*, between the sources of the rivers *Tobol* and *Ischim*, whither very few people frequented, there were to be found great numbers of images cut in stone, of men and beasts, and that the ruins of several cities were discernible in those deserts. And as the mountains of *Uiu-tau* and *Kit-zic-tau*, which are called *Arr-tag* and *Karr-tag*, lie between the said rivers, on the first of which the great *Tamerlane*, or *Timur-Beck*, when he passed by with his army, erected obelisks; and near which place the great *Ogus-Chan* had his residence. See *l'Histoire de Tim. Beck*. tom. ii. p. 36 and 81. So this relation is indeed very probable; but I much regret, that during my stay in *Siberia*, I had no opportunity of going to visit them in person.”

In those countries the course of nature appears to be reversed. In southern climes, the rivers in general run from the south to north into the *Mare Glaciale*, or Frozen Sea; therefore, presuming that this author's description, where, he says, between the source of the rivers *Tobol* and *Irtisch*, that it is to the south-west of *Tobolsky* where we see this apparently rise, is an immense desert district between the 45th and 55th degree of N. latitude, of course including that which M. Bailly speaks of, and which district of country is called *Step*, *YSCHIMSCA*, lying about 200 English miles to the north-east of the *Caspian Sea*. It should be remarked that, in the Slavonian tongue, *Step* is another term for *Deserta*.

OF THE FIXED STARS.—To what has preceded upon the celestial sphere, the following may be added. The apparent motion of the stars, and their different altitude, are occasioned by the diurnal motion of the earth, and the different position of a spectator on its surface.

And although the fixed stars keep their relative places

with respect to each other, yet they change their situation very much with regard to *us*, some appearing rising, others setting, some describing large circles, others small; some going over our heads, others just rising above the horizon, and then disappearing. Some stars neither rise nor set, but seem to turn round one immoveable point, near which is placed a single star, called the *north pole*, or *polar star*. This star appears more or less elevated above the horizon, according to the part of the earth from whence it is viewed. As we go north it gradually rises, and were we to reach the north pole of the earth, the polar star would appear directly over our heads; and we should see only the stars of the northern hemisphere, none of which would ever set; they would all appear to move round in circles parallel to the horizon; whence this is called a **PARALLEL SPHERE**.

Should a spectator go south, he would see the polar star gradually sink, till he reached the equator, when it appears in the horizon. There may be seen the stars of both hemispheres; all of them rising and setting perpendicularly to the horizon, so that, like the sun, they are exactly twelve hours above the horizon, and twelve hours below it; and the whole heavens resemble a large concave sphere bespangled with stars, moving round two immoveable points, which, like the ends of an axis, remain fixed in the *horizon*; hence this is called a **RIGHT SPHERE**:—to have a correct idea of the starry firmament, a spectator should be placed in this situation.

When we cross the equator and go southward, the pole-star gradually disappears, and then as we progressively advance, the stars next to it. The south pole proportionally rises, and the stars around it, which are all some distance from the pole; so that no one of them has the name of the polar star, as in the north.

In every other part of the earth, except at the equator and at the poles, the stars seem to rise and set obliquely, with respect to the horizon, whence it is called an **OBLIQUE SPHERE**.

The fixed stars have been divided by astronomers into certain parcels, called **CONSTELLATIONS**; and the number of visible stars in each, with their position and magnitude, are ascertained.

The stars, from their different apparent size, are divided into six classes, called *magnitudes*; those, the largest and brightest, are called stars of the *first* magnitude; those next in size and splendour, of the *second*, and so on, till we come to the *sixth*, and even *seventh* magnitude. Beyond those

again, there are yet more stars, which an unassisted eye cannot perceive; those are called **TELESCOPIC STARS**.

The number of stars visible at once to the naked eye, in either hemisphere, does not exceed one thousand.

We have already seen who first numbered the stars; it was Hipparchus of Rhodes, before the Christian æra 120 years. (*Vide article ASTRONOMY.*) He divided those into the following,—the zodiac contained 12, already described; above, or to the north of it, 21, and to the south thereof, 15, making an aggregate of 48; and containing 1032 stars altogether. One constellation in each region has been added by successive astronomers, besides those made by Hevelius, from the *unformed stars*, after mentioned.

The *ancients* gave various names to these constellations, the reasons for which are involved in fable.

Such stars as were not included in either of those ancient divisions were called *unformed stars*, from which Hevelius composed 10 constellations.

Having in the article *Astronomy* furnished certain particulars respecting the local situation, motion, distance, diameters, &c. of the several planets in the solar system, and likewise of those constellations forming the signs of the zodiac;—we shall now give the names of the remaining constellations, with the number of stars contained in each.

The *ancient* constellations north of the zodiac are *Ursa minor*, the lesser bear, containing 24 stars; *Ursa major*, the great bear, 87; *Draco*, the dragon, 80; *Cepheus*, father to Andromeda, a king of Ethiopia, 35; *Bootes Arctophilox*, the keeper of the bear, 54; *Corona borealis*, vel *Septentrionalis*, the northern crown, 21; *Hercules*, or *Engonasis*, the man on his knees, 113; *Lyra*, the harp, 21; *Cygnus*, the swan, 81; *Cassiopeia*, the wife of Cepheus, and mother of Andromeda, represented as sitting in a chair, 55; *Perseus*, the deliverer and husband of Andromeda, with the head of Medusa, 59; *Auriga*, the waggoner, 66; *Ophirichus*, *Anguitenens*, or *Serpentarius*, the man who holds the serpent, 74; *Serpens*, the serpent, 64; *Sagitta*, the arrow, 18; *Aquila*, the eagle, 71; *Delphinus*, the dolphin, 18; *Equuleus*, vel *Equisetio*, the horse's head, 10; *Pegasus*, vel *Equus*, the flying horse, 89; *Andromeda*, 66; and *Triangulum*, the triangle, 15.

The *ancient* constellations in the southern regions were, *Cetus*, *Pristis*, *Pristris*, vel *Pristrix*, the whale, to which Andromeda was exposed, and from which she was freed by Perseus, 97; *Orion*, a famous hunter of enormous size, 78;

Eridanius fluvius, the river Eridanus or Po, in Italy, 84; *Lepus*, the hare, 19; *Canis major*, the greater dog, 31; *Canis minor*, the lesser dog, 14; *Argo navis*, the ship Argo, 64; *Hydra*, the water serpent of Lerna, 60; *Crater*, the cup, 35; *Corvus*, the crow, 9; *Centaurus*, the centaur, 35; *Lupus*, the wolf, 24; *Ara*, the altar, 9; *Corona australis*, the southern crown, 12: and *Piscis australis*, the southern fish, 24.

The southern constellations, mostly invisible to us in the north, are, *Columba Noachi*, Noah's dove, 10; *Robur Carolinum*, or the royal oak, formed by *Halley*, commemorative of the tree which protected King Charles II., 10; *Grus*, the crane, 13; the *Phœnix*, 13; *Indus*, the Indian, 12; *Pavo*, the peacock, 14; *Apus*, vel *Indica*, the bird of paradise, 11; *Apis*, vel *Musca*, the bee or fly, 4; the *Chamelion*, 10; *Triangulum australe*, the southern triangle, 5; *Piscis volens*, the flying fish, 6; *Dorado*, vel *Xiphias*, the sword fish; *Toucan*, the American goose, 9; and *Hydrus*, the water snake, 10.

The new constellation in the zodiac is *Coma Berenice*, Berenice's hair, near the Lion's tail; and in the northern regions, *Antinous*, near the Eagle.

The constellations formed out of the unformed stars by Hevelius, are the *Lynx*, 44, between *Gemini* and *Ursa minor*; *Leo minor*, the lesser lion, between *Leo* and *Ursa major*, 53; *Asterion*, vel *Chara*, vel *Cor Caroli*, the grayhound, between *Ursa major* and *Bootes*, 25; *Cerberus et Ramus*, Cerberus and the branch in the right hand of Hercules, 4; *Vulpecula et Anser*, the fox and goose, between the swan and the eagle, 35; *Scutum Sobieski*, Sobieski's shield, or the cross, 7, near *Sagittarius*; *Lacerta*, the lizard, between *Pegasus* and *Cepheus*, 16; *Camelopardus*, between *Cassiopeia* and *Ursa major*, 58; *Monoceros*, the unicorn, 31, near *Canis major*; *Sextans Urania*, the sextant of Urania, or the sixth part of a circle, 41, near *Hydra*: to these add mount *Menalus*, near the serpent, *Musca*, the fly, and the lesser triangle, between *Aries* and *Perseus*.

In the number of stars annexed to each constellation, and usually marked on modern globes, are included a great many visible only with a good telescope.

Some of the principal stars have proper names assigned them; as *Sirius*, or the dog-star, the largest and brightest of all the stars, in the mouth of the greater dog; *Procyon*, in the lesser dog; *Aldebaran*, or the bull's eye; *Capella*, or the goat, in the waggoner; *Arcturus*, between the legs of *Bootes*; *Castor* and *Pollux*, two stars in *Gemini*; *Hædi*, the kids, two stars in *Auriga*, near *Capella*: so certain

clusters of stars, as *Pleiades*, or the seven stars, in the bull's neck; *Hyades* or *Sacula*, near the bull's eye, &c.

All the stars marked on most celestial globes, or charts of the stars, in each constellation, are distinguished by the letters of the Greek and Roman alphabets, which mark them as exactly as proper names; as we have seen to have been the contrivance of J. Bayer in 1603, the largest star distinguished by the first letter α , and so on, until the Greek alphabet is exhausted, when the Roman alphabet commences.

There is a particular tract in the sky of a whitish colour, which goes round the whole heavens, from S.W. by W. to N.E. by E. called *Via Lactea*, the Galaxy, or Milky Way; occasioned, it is thought, by an innumerable multitude of stars placed in it, which are not distinctly visible to the naked eye.

Besides this indefinite congregation of stellary substances, there are many other parts of the heavens brighter than the rest, called NEBULÆ, of which, very few, indeed, are perceptible to the unassisted eye. Of these, Dr. Herschel has given a very large catalogue; only 103 had been ascertained before. This illustrious astronomer has discovered certain luminous points in the heavens, which from their uniform and steady light, he calls *planetary nebulae*.

All these *nebulae* are supposed to be produced by the blended light of a vast number of small stars, many of which have been discovered by means of the recent improvements in telescopes,—whereby, also, the real number of the stars has been found to be great beyond conception. We may form some idea of that, from the calculation of the same accurate observer, that he discovered in one quarter of an hour there passed through the field of view of his great telescope, no less than 116,000 stars.

For who can dare prescribe limits to the Great God of Nature? Shall frail—shall finite man presume to enchain the eternal will of the most Highest? He may, perhaps, answer the purpose of his being, if in his most studious and active contemplation he finds a sufficiency of wisdom and of power to make him confess the infinity of the Almighty mind, and to discover his own insignificant puerility.

Although the fixed stars appear to remain in the same situation with respect to each other, yet many of them are found to undergo particular changes, which has induced some astronomers to think that all the stars have a certain motion similar to that in the solar system, which their extreme distance prevents us from perceiving.

Some stars, known to the ancients, are no longer to be seen; whilst certain other new ones have been discovered by the moderns. Some new stars have appeared all at once, with surprising splendour, and in a short time have entirely disappeared; an instance we have seen in the preceding memoir of Tycho Brahe, who discovered a new star in Cassiopeia; also as that in the time of Hipparchus, which induced him to compose his catalogue. The star mentioned to have been discovered by the Danish astronomer, in 1572, is the first upon record found by the moderns, which remained till 1574; since which time, however, several others have been observed.

Certain stars have been found to disappear, and then at certain periods appear again; such have been called by the unmeaning term of *re-apparent stars*. These unquestionably belong to other systems of suns in the boundless extent of immensity. Therefore, we may conclude, that although the most sagacious and rational of the species have come to many important conclusions, that future ages will yet have much to learn; so much, we may think, that the yet unborn will smile at the simple endeavours of a Newton, a Herschel, or any other profound observer of nature.

We certainly may form some slight conception of the immense distance of the fixed stars, by considering, that, although the earth, at certain periods in her orbicular evolution is 190 millions of miles nearer the fixed stars than she is at another, when she is at the opposite extremity of her ellipse, yet their magnitude and brightness are not in the least altered, and the polar star in every part of the terrestrial orbit always appears to us in the same position; hence it is but just to conclude, that the whole extremity of the earth's orbit is but as an imperceptible point in comparison of the distance of the fixed stars.

We shall here conclude our weak observations upon the celestial part of nature, and have in brief brought the present article on natural philosophy to a conclusion; at the same time we confess, that in our own conception, we have failed much of that degree of perfection to which our imperfect view aspired: how far then—how very far short of what it merits, let those determine, whose knowledge may enable them to judge. Not to trouble the world with our crudities, puerilities, or excuses, which they might deem frivolous, but which we are conscious they would appreciate, did they know the very peculiar disadvantages under which we have laboured in the production of this article.

Memoir of the Rev. EDMUND GUNTER.

The Rev. *Edmund Gunter*, an eminent mathematician, was descended from a reputable family in Brecknockshire, in South Wales; but was born in the county of Hereford, in 1581. He was educated on the royal foundation in Westminster School; elected to Christ Church College, Oxford, in 1599; graduated B.A. in 1603, and M.A. in 1606. At or about this time he took orders; in 1615, he took also the degree of B.D.

From his youth he was much addicted to mathematical studies; in proportion as he advanced in life his reputation in this branch of knowledge increased: his fame in this science recommended him to the most eminent mathematicians of the day; so that upon a vacancy occurring in the professorship of astronomy in Gresham College, London, in 1614, upon the resignation of Mr. Williams, on the 6th of March in that year, Mr. Gunter was elected to succeed him.

About the year 1606, he distinguished himself by a new and improved projection of his sector, of which he wrote a Latin description, circulated in MS. among his friends, and afterwards printed. It appears, that prior to 1618, he had invented a portable quadrant, which served for more easily finding the hour and azimuth, as well as other useful purposes in astronomy. Soon after his election into Gresham College, *i.e.* in 1620, he published his "*Canon Triangulorum, sive Tabula Sinum et Tangentium artificialium ad Radium 100,000,000, et ad scrupula prima Quadrantis,*" to which were annexed the first 1000 of Briggs's logarithms of common numbers. A second edition of this work was published in English, in 1623, under the title of "*Canon Triangulorum, or a Table of Artificial Sines and Tangents to a Radius of 100,000,000 Parts to each Minute of the Quadrant;*" to which were added logarithms of absolute numbers, from an unit to 10,000, with a rule for augmenting them to 100,000. It should be noticed, because to the honour of Mr. Gunter, that these were the first tables of the kind that were ever published. The utility of these tables is appreciated by mathematicians and astronomers, as they facilitate the resolution of spherical triangles, without the aid of sextants, or versed sines, and substitute the operations of addition and subtraction for those of multiplication

and division. Mr. Gunter's claim to the successful application of logarithms to the solution of spherical triangles, is established by the experience of several professors. Mr. Gunter discovered by experiment, made at Deptford, that the *magnetic needle* varied almost 5° in the short space of forty-two years, which his successor in the professorship at Gresham College, Mr. Gellibrand, afterwards fully proved.

The next invention of Mr. Gunter was, if a preference be due to any, from the superior and general utility, his famous scale of proportions, by which he applied the logarithms of numbers, and also of sines and tangents to straight lines drawn on a rule or scale; by means of which, proportions in common numbers, and in trigonometry, may be resolved with a pair of compasses; in consequence of that, the now well-known principle that the logarithms of the terms of equal ratios are equi-different. This was called *Gunter's Proportion*, and also *Gunter's Line*; and the instrument was constructed in the form of a two-foot scale, which is in common use for nautical and other purposes, and is commonly called *The Gunter*. This invention was communicated in 1624, to the French mathematicians at Paris, by Mr. Wingate, who published it in the French language.

He occupied the professorship till his death, in 1626, at the age of 45 years. He was buried in the church of *St. Peter le Poor*, Broad-street, where his remains still lie undistinguished from any common earth, without a token to indicate that so great a genius had ever existed. This instance of ingratitude in scientific posterity, serves to confirm a remark often made upon the want of fellow feeling in the sons of cold-hearted science. Much as we discountenance general accusations, we cannot but believe that there is truth in *this*; at all events, this particular circumstance confirms the stigma upon the scientific character.

The inventions of Gunter were, perhaps, of more practical utility than even those of the great Archimedes, whose tomb *Cicero* discovered and decorated when Questor of Syracuse. He ordered its restoration to beauty, knowing it to have belonged to the geometrician. Should it be required to be determined to which order of genius the more purely intellectual abilities are required for its exercise,—we think the palm would be adjudged to the mathematician; this science being so purely abstract, so independent of all materials, yet comprehending all matter, leading it up through all material creation. Then is it not a disgrace to

our age and country, to forget the most eminent members of our community, our public benefactors? This cannot be defended,—but it may be remedied!

Several years after Mr. Gunter's death, Mr. Wingate also re-published in English his *Observations upon Gunter's Mechanical Mathematics*, with additions and improvements; this scale has since been also called Wingate's Rule of Proportion, but more generally *Gunter's Line*. This line consists of the logarithms transferred upon a rule from the tables, by means of a scale of equal parts, so as to answer nearly the same.

In 1624, he published by order of King James, a tract, intituled “The Description and Use of his Majesty's Dials in Whitehall Garden,” 4to. It should appear that those curious dials were also drawn and designed by this ingenious man; but, being since defaced, any further notice of them would be superfluous.

This ingenious man was the first who used the term *co-sine* for the sine of the complement of an arc; and he also introduced the use of *arithmetical* complements into logarithmic arithmetic. It has also been said, that he first suggested the idea of the “*logarithmic curve*,” so called, because the segments of its axis are the logarithms of the corresponding *ordinates*.

Mr. Gunter also introduced the common *measuring chain*, now constantly used for *land surveying*; hence known as *Gunter's Chain*. The length of the chain is 66 feet, or 22 yards; or 4 poles of $5\frac{1}{2}$ yards each: it is divided into 100 links, of $7\frac{1}{2}$ inches each. This chain is the most convenient of any thing for measuring land, because the contents therein computed are easily turned into acres. The reason of which is, that an acre of land is just equal to 10 square chains, or 10 chains in length and one in breadth, or equal to 100,000 square links.

Hence, the dimensions being taken in chains and multiplied together, give the contents in square chains, which therefore being divided by 10, or a figure cut off for decimals, brings the contents to acres, after which the decimals are reduced to roods and perches, by multiplying by 4, and then 40; but the better way is to set the dimensions down in links, as integers, considering each chain as 100 links, then having multiplied the dimensions together, producing square links, divide them by 100,000, that is, cut off five places for decimals, the rest are acres, and decimals are reduced to roods and perches as before: *ex. gra.* Suppose

a field to be measured be 887 links in length and 750 links in breadth; to find its area we say,

$$\begin{array}{r}
 887 \\
 750 \\
 \hline
 44350 \\
 6209 \\
 \hline
 6.65250 \\
 4 \\
 \hline
 2.61000 \\
 40 \\
 \hline
 24.4
 \end{array}$$

Contents are 6A. 2R. 24P.

Gunter's Line.—A logarithmic line usually graduated upon scales, sectors, &c. It is also called the line of lines, and line of numbers, being only the logarithms graduated upon a ruler, which therefore serves to solve problems instrumentally, in the same manner as logarithms do arithmetically. It is usually divided into 100 parts, every tenth thereof is numbered, beginning with *one*, and ending with *ten*; so that if the first great division marked 1 stand for one tenth of any integer, 2 will stand for 2 tenths, and the intermediate divisions will in like manner represent 100th parts of the same integer. If each of the great divisions represent 10 integers, then will the lesser divisions stand for integers; and if the divisions be supposed each 100, the subdivisions will be each 10.

Gunter's Line, the Use of.—"To find the product of two numbers." From 1 extend the compasses to the multiplier; and the same extent applied the same way from the multiplicand, will reach to the product. Thus if the product of 4 and 8 be required, extend the compasses from 1 to 4, and that extent laid upon 8 the same way, will reach to 32 their product.

2d. "To divide one number by another." The extent from the divisor to unity will reach from the divisor to the quotient; thus to divide 36 by 4, extend the compasses from 4 to 1, and the same extent will reach from 36 to 9, the quotient sought.

3d. "To divide three given numbers to find a fourth proportional." Suppose the numbers 6, 8, 9; extend the

compasses from 6 to 8, and this extent laid from 9 the same way will reach to 12, the fourth proportion required.

4th. “ *To find a mean proportional between any two given numbers.*” Suppose 8 and 32; extend the compasses from 8 on the left-hand part of line to 32 on the right, then bisecting this distance, its half will reach from 8 forward, or from 32 backward to 16; the mean proportional sought.

5th. “ *To extract the square root of any number.*” Suppose 25; bisect the distance between 1 on the scale, and the point representing 25, then the half of this distance set off from 1, will give the point representing the root 5. *In the same manner, the cube root, or that of any other higher power may be found by dividing the distance, on the line between 1 and the given number, into as many equal parts as the index of the power expresses; then one of these parts set from 1, will find the point representing the root required.*

Gunter's Quadrant. — One made of wood, brass, &c. containing a kind of stereographic projection of the sphere, on the plane of the equinoctial, the eye being supposed to be placed in one of the poles. Besides the use of this quadrant in finding heights and distances, it serves also to find the hour of the day, the sun's azimuth, &c. and other problems of the globe.

Gunter's Scale, — Usually called by seamen *the Gunter*, is a large plane scale, having various lines upon it, of great use in working the cases or questions in navigation. This scale is nearly two feet long, and about an inch and a half broad, with various lines upon it, both natural and logarithmic, relating to trigonometry, navigation, &c. On the one side are the natural lines, and on the other the artificial or logarithmic ones; the former side is first divided into inches and tenths, and numbered from 1 to 24 inches, running the whole length near one edge. One half the length of this side, consists of two plain diagonal scales for taking off dimensions to three places of figures. On the other half or foot of this side, are contained various lines relating to trigonometry, in the natural manner, and marked thus; viz.

- Rumb, the rumb or points of the compass;
- Chord, the line of chords;
- Sine, the line of sines;
- Tang. the line of tangents;
- S.T. the sine tangents; and all the other end of this half are,
- Leag. leagues or equal parts;

Rumb, another line of rumbs;

M. L. miles of longitude;

Chor. another line of chords.

Also in the middle of this foot are L and P, two other lines of equal parts: and all these lines on this side of the scale serve for laying down the figures to the cases in trigonometry and navigation. On the other side of the scale are the following artificial or logarithmic lines, which serve for working or resolving those cases, viz.

S. R. the sine of rumbs;

T. R. the tangent rumbs;

Numb. line of numbers;

Sine, sines;

V. S. the versed sines;

Tang. the tangents;

Meri. meridional parts;

E. P. equal parts.

There is, perhaps, no apology required for the insertion of this article in this place, since practical utility sanctions it.

PHYSIOGNOMY AND CRANIOLOGY.

THESE sciences, if those can be called sciences which are yet comparatively in infancy; because a sufficiency of observation has not been made upon them from well authenticated facts, supporting *each other*, to constitute what is thought the basis of *science*; yet these have been thought so pertinent in numerous instances, that we think we may venture to pronounce them *sciences in embryo*: they have now our attention. Although, as surmised, we may not have much historical matter to adduce, we think it proper to give the principles upon which the chief supporters of them have acted, and which they pronounce to be clear and definite.

The first-named *science in esse*, claims an ancient and high descent, even as remote as the period of *Admantius* and *Aristotle*, who have both written upon it; of the treatise of the latter, we have a Latin translation by *Lacuna*. The most eminent of writers who have since discussed these subjects, are *Baptista Porta*, *Robert Fludd*, *GALL*, *Campan*, *Kant*, *LAVATER*, and *Blumenbach*. The hero of late physiognomical writers is *J. Caspar Lavater*; and of its sister science, Craniology, Professor *Gall*, of Vienna, the inventor.

Etymology.—The term *Physiognomy*, which is the first

of the two subjects we treat upon, is derived from a Grecian compound in that language, *φυσιογνωμία*, coming from *φύσις*, *natura*, nature, and *γινώσκω*, *gno*, I know; *vel gnaratis*, knowledge. *Physiognomy* refers to the surface of the head; and *Craniology* goes to its *basis*, or interior. Those sciences suffer the fate of most newly adopted discoveries, not being yet sufficiently identified by popular belief. Like the doctrine of *Harvey*, the illustrious discoverer of the circulation of the blood, they are reviled, mis-stated, and vilified, as was that noted discovery in the time of *Harvey*; and for years after his death, the college of physicians and surgeons, previous to their admission of new members, compelled them to swear by solemn oath that they *did not believe in its circulation!*¹ and treated as merely visionary, and their supporters derided with the sneers and abuse of the would-be scientific world.² In the present state of public opinion, we do not mean to impose our belief as the criterion of truth; nor do we wish to place obstacles in the way to the perfection of those sciences, of which their supporters appear to be firmly persuaded of their evident existence; but, on the contrary, advise an impartial investigation. All we can do, shall be done without prejudice, which is—impartially to state the evidence of their professors in their favour, with such ostensible arguments that have been urged against them. Having done this, we hope to discharge our duty to science, and not be found wanting in that respect we feel for a liberal-minded and enlightened public.

The supporters of physiognomy first state, that they regard the human face as the *index* to the mind; they add that it bears an evident analogy to the dial-plate of a recorder of the progress of time: whilst the feelings which operate on the mind, give impulses to the will, and direct the corporeal motion of the frame, they say, these are to be regarded as the mechanism in the interior of a clock, which directs the hand to the hour: by a frequent repetition of our feelings, they say, the features acquire a habitude to evidence certain expressions in the countenance, superior or paramount to all other feelings, impressing the face with an unfailing index to the prevailing temperament of the mind. This statement appears to be extremely probable

¹ This we state on the authority of Dr. *Thornton*, in his popular lectures upon "the circulation of the blood."

² Innumerable other instances could be adduced of the folly of the human species, and of the sufferings of illustrious individuals; to instance only the examples of *Socrates*, *Galileo*, and *Copernicus*.

and very natural. Insomuch so, that an early physiognomist, being introduced to *Socrates*, without knowing his name, or being at all familiar with the virtues which distinguished that god-like man, was asked to give the company his idea of the physiognomy of that philosopher. With a simplicity natural to the age, which was distinguished for *truth*, he, without disguise, informed them that the person of whom his opinion was desired, was naturally addicted to every vice which can be said to disgrace the human character, enumerating them at the same instant: on this the whole company burst into derision on the absurdity of the pretended science; the witling laughed at its professor; but not so the philosopher, who was the occasion of their present exultation; he requested them to suspend their judgment; and then informed them, that “he was, indeed, by nature inclined to those vices the physiognomist had mentioned; but that he had conquered these natural feelings, and subdued those affections by the practice of reason and philosophy.” This circumstance, to the best of our recollection, is mentioned by *Xenophon*, in the life of that philosopher, which precedes his *Memorabilia*; and although it must be unquestionably known to the opposers of the science under consideration, they have industriously kept it hidden.

From this digression we return. Now, it is said, that by repeated acts, or the frequent entertainment of any favourite propensity, affection, or passion, impressed by natural temperament, or dragged by custom into the habits of an individual, the face is often put in a posture which attends such affections or actions, in consequence of a passage forced by the animal spirits through the nerves, in which the essence of a habit consists, as the religious Indians are said to distort their limbs by long sitting or standing in any peculiar posture; or, at least, it falls insensibly, and, as it were, mechanically, into some certain and settled position, directed by mental temperament, unless when under the influence of a stronger and contrary passion, or concealed by the flexibility of disguise and design. Observation has frequently confirmed this position; and we may here add, that so apparent are certain inclinations of the mind in various individuals, that we cannot well be mistaken in estimating character: indeed, in this respect, a *dog* has sagacity enough to discover, not only the disposition of its master, but also to appreciate the character of certain strangers to a given extent. Which we submit as an incontestible evidence of the existence of this *index* of the mind; because with the subtleties of human ingenuity, in the construction of systems,

those animals are presumed to be unacquainted, as they evidently are with the vice of dissimulation.

We are of opinion, that the favourers of this science would do well to divide it into two distinct branches: *first*, such characteristic traits which proclaim fixed and certain dispositions, generated like those defined in the preceding paragraph, as founded upon mere principles of *habit*, and fixed in the physiognomy of the face: and, *secondly*, those where the expressions are *transient*, and are the indice to certain local dispositions of the mind; so as from one expression to draw a probable conclusion of its successor, and of those thoughts which, at that instant, occupy the mind of the individual.

The science of man, in respect to his exterior appearance, is certainly influenced by a great variety of causes, much too numerous for us to investigate in our very circumscribed limits; nevertheless, to instance some few particulars of national characteristics, the *climate, soil, atmosphere, provisions, habits*, with several local *et ceteras*, should be certainly distinctly considered. Agreeable to this idea, Professor *Kant*, of Königsberg, in his essay on this subject, has divided the vast mass of humanity into *four* distinct classes; which may be thus briefly enumerated; 1st, Whites; 2d, Negroes; 3d, Huns, Moguls, or Calmucs; and 4th, Hindoos, or the natives of Indostan.

Circumstances purely external, the opposers of this science say, and probably with justice, and which may be accidental, cannot be the original causes of what is assimilated or inherited. It is readily conceded those events they enumerate are not the original cause, but as they occur, they assist that cause in the performance of certain effects, to which they also communicate a peculiarity of character. "As well," they continue, "could chance produce a body perfectly organized." The Professor proceeds by observing, that "man was undoubtedly intended to be the inhabitant of all soils. Hence the fact that many internal propensities must be latent in him, which shall remain inactive, or be put in motion according to his situation on the earth, so that in progressive generations, he shall appear as if born for the particular soil in which he seems planted."

It is this gentleman's opinion, "that the air and sun are the two chief causes which influence the operations of generative propagation, which give a lasting developement of *germ*, and the chief propensities to the individual." The objectors say, "or in other words, the above powers may be the

origin of a new race." We can answer for the Professor, and allege he had no such hyperbolic idea in contemplation. He proceeds—"Food may produce some slight variations; these, however, after emigration, must soon disappear, and cease their operation as well on the source of life as on that of animal conformation and motion." It has been also observed, that the nearer man approaches to the frigid zone, the more he is reduced in stature. This appears certainly as a necessary consequence of that situation; because independent of its being the very physical nature of cold to shorten and depress, as is invariably found to be the case, as previously observed in the figure of the earth itself, and in the *pendulum*, whence the extension at the equator is accounted for from *heat*, as its opposite principle,—the evanescence at the poles, was justly ascribed to the only ostensible cause, *cold*. Indeed, were not this ascertained to be a fact, the visible difference in the case of the pendulum would immediately determine the question. But independent of this, the economy of nature appears to have conformed to this circumstance, in rendering the human stature shorter the nearer it approaches the pole, and for this evident reason: the expanding power of the heart to force the blood to the extremities, must have been of necessity increased; as it is in this action of the vital liquid the heat of the frame consists. If this circulating medium were not duly impelled through the frame, the members left without its benefit, would become chill, and totally useless; but the Creator ordered the economy of the frame in those parts to be constructed upon a different principle; the stature has been shortened, to confine the operation of its circulation to the trunk, where natural heat accumulating, the whole body has a greater proportion of the comfortable sensation of animal heat; the reverse of which is so sensibly experienced by strangers visiting that country.

The inclination of the human face to flatness, in those parts, when the same features among different people are generally prominent. In those inhabitants last mentioned, their high cheek bones, and small and imperfect eyes, are believed to be so produced in consequence of the previously named cause; their eyes, it is probable, appear small and twinkling from habit, occasioned by the necessity of keeping them almost constantly shut, to avoid the piercing winds, and the offensive whiteness of the almost eternal snows found in that region.

The *Abbé Winckelman*, is said to attribute the enormous

and, as he thinks,³ disgusting lips of the African negroes, to the heat of the climate they inhabit. Others account for the blackness of their skin, from supposing the excess of ferruginous particles in their blood, which have been found of late, on chymical analysis, to a greater or less degree, to exist in that of all men, and which occasions its sanguine colour, and which, in them, the negroes, is conceived necessary in order to strengthen and support the frame under the oppressive influence of the extreme solar heat which they endure, and this producing blackness through the transparent *cuticle* which covers the frame; to which cause, may be added, the evaporation of those phosphoric acidities which smell so strong in that people, being cast upon the *retina-form* membrane.

In pointing out the distinguishing traits which discriminate the natives of different regions, Lavater observes, that a person deeply enamoured of another, and thinking intensely on the form and position of the features, might in process of time assume a resemblance of the admired object, though miles of space intervene between them; and, pursuing his mental dream, he adds—"that it is equally possible an individual meditating revenge, may compose his countenance into a likeness of him who was to be his victim."⁴ The incorrectness of the latter fancy may be exposed by merely observing that the person under the influence of the passion of revenge, must bear in his countenance the lines of expression of that restless affection. Now as the object intended to be injured is unconscious of the secret machinations against him, he may at the instant be engaged in some benevolent pursuit, or may feel some internal joy, which moulds his features into an expression just the reverse of his adversary, who may generally have seen him thus: for revenge is often aimed by the wicked at the best of men; consequently, the countenance of a fiend cannot at the same time beam with complacency, or form a set of features where the soul is in equanimity. With the latter sentiments we perfectly agree, and do not regard the physiognomist's remark as pertinent to his subject.

That Lavater was an enthusiastic theorist, we admit; and also concede that we do not believe him sufficiently philosophical in every case; but surely the weakness, infirmity, or

³ The Abbé should have consulted M. Marmontel, who appears to have possessed more correct ideas of beauty, and to have felt the luxuriance of pouting lips. *Vide his Letters.*

⁴ Here we are at a loss for the analogy, with his last named instance.

impetuosity of a judge does not invalidate the system of jurisprudence over which he presides:—that his feelings were amiable, is not denied; that he was liable to error, is what may be expected of every human agent. But with his failings we cannot but praise his partiality to the natives of our own island, where, if his judgment is not always correct, he assuredly appears to appreciate their general character with truth, as we presently shall discover, where he speaks of the physiognomical resemblance of various nations.

First, he asserts—“That each creature is indispensable in the vast compass of the creation;” but adding, “each individual is not alike informed of the truth of this fact,—as man only, is conscious that his own place cannot be supplied by another. The idea, thus conceived, he thinks one of the best and most fortunate consequences to physiognomy; and contends, that the most deformed and wicked persons are still superior to the most perfect and beautiful animal: because, they always have the power to amend, and in some degree to restore themselves to the place assigned them in the creation; and however their features may be distorted by the indulgence of their passions, still the image of their Creator remains, from which *sin* is only to be expelled, to render the likeness still nearer perfection.” In making those remarks which are the chief distinguishing traits of various regions, he observes, “that the placing of different persons together, selected from nations remotely situated from each other, gives at one glance their surprising varieties of visage.” Yet he acknowledges, that, to point out those variations, is a task of considerable difficulty; and his assertion that this may be done with more facility from a single individual than the mass of population, seems extremely probable. The French, he thinks do not possess equally commanding traits with the English; nor are they so minute as the Germans; and it is to the peculiarity of their teeth and manner of laughing, that he attributed his power of deciding upon their origin. The Italians, he appreciated, by the form of their noses, diminutive eyes, and projecting chins.

The eyebrows and foreheads are the criteria of the people of England. The Dutch possess a peculiar rotundity of the head, and have weak thin hair; the Germans, numerous angles and wrinkles about the eyes and in the cheeks; and the Russians are remarkable for black and light coloured hair, and flat noses.

He considers the natives of England, in the aggregate,

as the most favoured people upon earth, with respect to personal beauty, saying, they have the shortest⁵ and best arched foreheads, and that only upwards and towards the eyebrows, rectilinear, with full medullary noses, frequently round, but very seldom pointed, and lips equally large, with the addition of full round chins: still greater perfections are attributed to the eyes of the English, which are said to possess the expression of manly strength, generosity, liberality, and frankness; to which apparent indication in the face the eyebrows greatly contribute. With complexions infinitely fairer than the Germans, they have the advantage of escaping the numerous wrinkles found in the faces of the latter, and their general contour is noble and commanding.

Judging from our ladies, whom he had seen in this country, and from numerous portraits of others, he was led to say, they appeared to him to be wholly composed of nerve and marrow; tall and slender in their forms, gentle, and as distant from coarseness and harshness as earth from heaven!

We will supply a thought he left unfinished, and say,—Benignity and virtue are their characteristics. In beauty, they are confessed supreme! Here, their face is a certain index of their mind.

His own countrywomen, (*Switzers*,) he found to have many varieties. Those of *Zurich* are found to be generally meagre, and of the middle size, and either corpulent or very thin. If we pursue this subject further, we shall find the people of Lapland and parts of Tartary are of a very diminutive stature, savage countenances, flat faces, broad noses, large mouths, thick lips, peaked chins, with eyes yellow-brown, almost approaching to black, and lids retiring upwards; the grossest manners, and stupid beyond credibility; but of all human varieties, the natives of New Holland seem the most debased and miserable, tall and slender, to add to deformity, thick lips, large noses, wide mouths, they are taught from infancy to keep their eyes almost shut, to avoid the insects which continually swarm around them.

The more favourable side of this picture of national physiognomy, exhibits the people of *Cachemire*, *Georgians*, *Circassians*, and *Mingrelians*; neat, noble and formed

⁵ We never have understood a peculiarly short forehead to be a beauty: beauty, like health and happiness, certainly consists in a *medium*.

for admiration, particularly the females, whose charms of person and face are proverbial.

The author from whom these extracts are taken says, "Before we enter upon a description of the marks which, according to *Lavater*, point out the character of the possessor, it may be proper to give one or two instances of the fallacy and of the truth of the conclusions drawn from them, in order that our readers may form their own conclusions, as to the folly or propriety of entertaining a propensity to form a judgment from the shapes of their noses, eyes, foreheads, and chins."

M. Sturtz declared to *Lavater*, that he once happened to see a criminal condemned to the wheel, who with Satanic wickedness had murdered his benefactor, and who yet had the benevolent and open countenance of an angel of *Guido*. It is not impossible, adds that gentleman, but that the head of *Regulus* might be found among criminals, or of a Vestal in the house of correction. *Lavater* admits this to its full extent; but his reasoning, to reconcile it to his system, is by no means conclusive.⁶

We must acknowledge, when we hear of any criminal action attended with very strong circumstances of individual guilt, the imagination assists us in drawing a picture of the culprit, agreeable to our own idea of his deformity; and without reflecting that the murderous assassin is marked by no horrible exterior, which would have placed humanity on its guard against his wicked intentions. However, upon viewing the culprit, we are, perhaps, surprised to find that there is nothing in his appearance particularly indicative of cruelty. To complete the outlines of his portrait, we then industriously endeavour to discover the latent marks of villany lurking in his eyes, converting the wrinkles of his face into the dens of savage cruelty; disease or age are turned into some horrible impression answering our expectations; and we depart exclaiming against the striking contour of the miserable wretch, when perhaps many of our near friends, or even relations, would suffer by a comparison, who yet had led uniformly innocent lives. On the other hand it must be

⁶ We may be excused here in observing, that provided Physiognomy could be reduced to those certain rules upon which sciences proceed and are founded, it would be most useful to mankind generally, and to the theatrical world in particular. We cannot but regard it as worth the experiment of the liberal-minded to endeavour to afford protection to a science which promises so much, as to enable us to form a correct judgment from the mode of *gestural expression and physiognomical peculiarity*, in opposition to the deception of the tongue of man to flatter or to deceive by hypocrisy.

confessed, that vice generally stamps her votaries with indelible marks which we cannot mistake at a glance; but this remark can only, perhaps, apply to the confirmed enemies of virtue, whose actions are so uniformly vicious that very little propriety occurs in their conduct.

“ The following anecdote, as related by Lavater, may serve partially to illustrate the before-made observations, showing that the features, or more correctly, the membraneous ligaments of the face, are affected by the turn of the mind; and if that is not *one part* of the position which the physiognomist means to establish, we do not know where to find it. An innocent young lady of high birth, educated in the retirement of the country, happened one evening to be passing a mirror with a candle in her hand, immediately after evening prayers; she had in the other hand a bible, which she laid upon a table: her eye in passing the glass showed her her own form; she instantly averted her eyes and retired. A succeeding winter had passed in the amusements and dissipation of a gay metropolis; she happened to pass the same glass in a state of mind forgetful of her former religious impressions; she now conceived her features deprived of that fascinating grace, which a serene and happy state of mind inspires: alarmed at the change, she flew to a sofa, ejaculated sentences of penitence, and formed resolutions for future amendment.”

Character of the Forehead.—Lavater appears to have been the first who attended to the peculiarities of the position and outlines of the forehead, which he considered the most important part presented for the study of the physiognomist. This he divides into three classes; these he terms *perpendicular*, *projecting*, and *retreating*, each possessing a number of variations: the principal, however, are rectilinear, half round, half rectilinear, flowing into each other; half round, half rectilinear, interrupted; curve lined, simple; the curve lined, double and triple.

A long forehead denotes much capacity of comprehension and less activity.

Lavater begins his remarks on the face with the forehead. According to him, and experience confirms his remarks, the general form, arch, obliquity, and position of the skull of the forehead, denote degrees of thought, sensibility, mental vigour, and the various propensities and aptitudes of the mind of man; at the same time the skin, bone, wrinkles, &c. explain the state of the mind of the individual at the moment of observation, and of the passing impressions which influence it; the shape of the bones affording

the internal quantity, and the covering the application of physiognomical power: however the latter may be affected, the bones must remain unaltered, and yet they regulate the wrinkles, by variation of their component form. Wrinkles are produced by certain degrees of flatness, others arise from arching; these considered separately give the form of the arch, and *vice versâ*; some foreheads are furnished with wrinkles that are confined to an horizontal form, some perpendicular, others curved, whilst others consist of confused or mixed lines; those least perplexed, when in action are usually distinct: some foreheads are without wrinkles. A short and firm forehead denotes compression, stability, and little volatility; serenity and pertinacity belong to the rectilinear; the more curved than angular portends flexibility and tenderness of character; deficiency of understanding is discoverable in those whose foreheads are perpendicular from the hair to the eyebrows; but the perfectly perpendicular gently-arched at the top signifies that the possessor thinks coolly and profoundly. The projecting forehead indicates stupidity and mental weakness; the retreating, exactly the reverse; the insular and prominent above, with straight lines below, and nearly perpendicular, shows sensibility, wisdom, and good understanding. The rectilinear oblique forehead has the same properties: as round foreheads are considered as feminine, with an union of curved and straight lines happily disposed into a similar position of the forehead gives the character of consummate wisdom. Right lines considered as such, and curves considered as such, are relaxed, as power and weakness, obstinacy and flexibility, understanding and sensation. When the bones surrounding the eye project and are sharp, the person thus formed possesses a powerful stimulus to strong mental energy, which is productive of excellent and well-digested plans; and yet this doth not seem a peculiar mark of wisdom, as many wise men have been known without it: those thus circumstanced have more firmness when the forehead rests perpendicularly upon horizontal eyebrows, and considerably rounded towards the temples. Perpendicular foreheads, however, which project so as not to rest on the nose, and which are short, small, shine, and full of wrinkles, give undoubted indications of weakness of the thinking faculty; perseverance and oppressive violent activity, united with vigour and hastiness, belong to the forehead composed of various confused protuberances; on the other hand, when the profile of this part of the head affords two well proportioned arches, the lowest projecting, it is a

certain sign of a good temperament and a sound understanding. All great and excellent men have been found to have their eye-bones finely arched and well defined.

Circumspection followed by stability attends square foreheads, with spacious temples and eye-bones of the above description; when perpendicular natural wrinkles appear, they express power of mind and application, but horizontal, interrupted in the middle or broken at the extremities, betray, in general, negligence, if not want of ability.

Deep indenting bones of the forehead, situated between the eyebrows, and extending in a particular direction, mark the happy few who possess generous and noble minds, connected with excellence of understanding; besides a blue *veina frontalis*, in the form of a Y, situated in an arched smooth forehead, is an indication of similar advantages.

We only remember one instance where this last case occurs, and that is in the person of the present Chief Justice of the King's Bench, whom we have had the honour to know for above twenty years.

Lavater having thus given the above hints, describes the supplementary characteristics of foreheads, which he asserts give the indubitable signs of an excellent and noble disposition: such must be one third of the face in length, or that of the nose; and from the nose to the chin, the upper part must be oval, in the manner of the great men of England, or nearly square; the skin must be smooth, and only wrinkled when the mind is roused to just indignation, or deeply immersed in thought; and during the paroxysm of pain the upper part must recede, and the lower project; the eye-bones must be horizontal, and a perfect curve: upon being observed from above, an intersecting cavity should divide the forehead into four distinct parts, but with that precise effect as to be only visible in a clear descending light; and all the outlines should be composed of such; if the section of one third only is observed, it would be difficult to decide whether they are circular or straight. To conclude this portrait of a transcendant forehead, the skin must be more transparent, and of a finer tint, than the remainder of the face. Should an infant, a relative, or a friend, who possesses a forehead resembling the above description, seriously err, the good enthusiast entreats that the corrector may not despair of success, as in all human probability the latent seeds of virtue may be raised into growth by perseverance, and finally produce the desired fruit.

The Eye.—The eyes of mankind are composed of va-

rious shades of colour, the most common of which are gray mixed with white, gray tinted with blue, and shades of green, orange, and yellow. According to *Buffon*, the orange and blue are most predominant, and those colours often meet in the same eye; those generally supposed to be black are not really so, and upon attentive examination they will be found to consist of yellow, a deep orange, a brown, which being instantly opposed to the clear white of the ball, assumes a darkness mistaken for black. The same naturalist observes that shades of yellow, orange, blue, and gray, are often visible in the same eye; and when blue, even if the lightest tint appears, it is invariably the predominant colour, may be found in rays dispersed through the iris; the orange is differently disposed at a trifling distance from the pupil; it is in flakes, and round, but the blue so far overpowers it, that the eye assumes the appearance of being wholly of that colour. The fire and vivacity emitted by the eye cannot be so powerful in those of the lighter tints; it is therefore in the dark ones alone that we look for the emotions of the soul. Quiet and mildness, and a certain degree of archness, are the characteristics of the blue. Some eyes are remarkable for the absence of colour; the *iris* is faintly shaded with blue or gray, the tints of orange are so light that they are hardly discernible: in eyes thus formed, the black of the pupil appears too conspicuous, and it may be said that portion is alone visible at a little distance, which circumstance gives the person possessing them what is called a ghastly and spectre-like appearance.

There are eyes whose iris may be said to be almost green, but these are uncommon. It would require the pen of an inspired writer to describe the astonishing variety of expression of which the eyes are capable; being situated near the supposed seat of the soul, every sensation of that invisible spirit appears to rush in full vigour from those intelligent organs; all the passions may be seen in them: we (the world) shrink from their indication of anger; we find pleasure with all her train of joys dancing in them; we feel their force in love; and melt into tears on observing them suffused in the moisture of grief: in short, their language is less deceptive, and more powerful than that of the tongue. The transitions are so rapid in the expression of the eyes, that it requires very close and attentive examination to catch and describe the emotions of the mind visible in them. Admitting this fact, saith our author, it will appear that the physiognomist is liable to numerous and egregious errors

in drawing his conclusions of propensities from them. *Paracelsus*, a man of strong genius, and like *Lavater*, misguided in many instances by enthusiasm, and a kind of superstition allied to the study of this art or science, pronounced that those eyes generally termed black, frequently denoted health, firmness, courage, and honour; but the gray, deceit and instability. Those objections, we conceive, are made only for the sake of ostentatious difference of opinion, if they are considered relative:—thus far probability at least accompanies the physiognomist's remarks. The commentator adding, “It is, however, impossible to subscribe to his assertion, that all short-sighted persons are deceitful and crafty, or that those who squint have similar propensities to evil: with this learned gentleman we fully coincide, when he alleges, that it is evident both peculiarities alluded to, may be consequences of injury, *either of natural defect or accidental violence*, and are never found in people whose organs of vision are perfect; indeed many instances might be cited of the actual and known cause of squinting and near sight, which frequently occur in adults, from extreme anxiety and disease.”

Small eyes, situated deep in the sockets, are said by *Paracelsus* to indicate active wickedness, with a mind calculated to oppose with vigour, and suffer with perseverance; and their opposites, very large and prominent eyes, he conceived explained the avaricious and covetous propensities of their possessors: those in constant motion, denote fear and care; winking is the mark of foresight, of an amorous disposition, when it does not proceed from the weakness in the organ, we suppose; and the eye fearful of looking forward, decides upon innate modesty.

Lavater thought blue eyes, in general, signified effeminacy and weakness; yet he acknowledged that many eminent men have had blue eyes; still he was convinced that strength and manhood belong more particularly to brown: in opposition to this, the Chinese are known to be an imbecile people, and they rarely have blue eyes. These contradictions, it must be confessed, weaken the reliance we are inclined to place upon appearances during the quiescent state of the eyes, and the indications of their colour. Men intemperate, in anger, and easily irritated, may be found with eyes of all the usual colours; when they incline to green,—ardour, spirit, and courage, are their usual attendants. People of a phlegmatic habit, but who may be roused to activity, have clear blue eyes, which never belong to those inclined to

melancholy; and rarely belong to the choleric. Benevolence, tenderness, timidity, and weakness, are exhibited by the perfectly semicircular arch formed by the under part of the upper eyelid. Persons of acute and solid understanding have generous open eyes, composing an acute angle with the nose; and when the eyelid forms an horizontal line over the pupil, it is a strong indication that he who possesses it is subtle, shrewd, and penetrating. Wide opening lids, showing the white of the ball under the other colours, may be observed in phlegmatic and timid, as well as in the courageous and rash; but in comparing these marks in the characters just mentioned, a very perceptible difference is discovered, the latter is more oblique, better shaped, and more firm.

The Eyebrows.—The eyebrows are essential in the expression of the eyes; in anger they are brought down and contracted; in all pleasant sensations, and in astonishment, they assume a fine arch; in youth they are naturally and regularly arched; the horizontal, and rectilinear eyebrows belong to the masculine bias of the soul, and when combined with the above designations, show strength of understanding, united with feminine kindness. Those that are deranged in their appearance, with the hair growing in various directions, demonstrate a wild and perplexed state of mind; but if the hair be fine and soft, they signify gentle ardour. The compressed eyebrow, formed of parallel hairs, is a certain proof of profound wisdom, true perception, and a manly habit of thought. There are eyebrows which meet across the nose; this circumstance gives the person an air of ferocious gloom, which is admired by the Arabs; but the ancients versed in physiognomy conceived such to be the character of cunning: *Lavater*, on the contrary, says he discovered them in the most open and worthy countenances, admitting, at the same time, they may indicate a heart ill at ease. Those who think profoundly, and those equally prudent and firm in their conduct, have never high and weak eyebrows, but in some measure equally dividing the forehead, they betray rather debility and apathy; and though men with an opposite character may be found with them, they invariably signify a diminution of the powers of the mind. Thick angular eyebrows, interrupted in their lengths, signify spirit and activity; and when they approach the eyelids closely, the more firm, vigorous, and decided is the character: the reverse shows a volatile and less enterprising disposition; when the extremes are remote from each other,

the sensations of the possessor are sudden and violent. White eyebrows are demonstrative of weakness, in the same degree as the dark brows are of firmness.

The good *Lavater* considers the nose as the abutment of the forehead, the seat of the brain, without which the face would present a miserable appearance, indeed an ugly or disagreeable set of features are never accompanied by a handsome nose; but there are thousands of fine and expressive eyes, where a perfectly formed nose is wanting. He describes the proportions of the face as requiring the following particulars. "Its length, (that of the nose,) should equal the length of the forehead; at the top should begin the indenting; viewed in front, the back should be broad, and nearly parallel, yet above the centre somewhat broader; the bottom or end of the nose should be neither hard nor fleshy, and its under outline must be remarkably definite, well delineated, neither pointed nor very broad; the sides seen in front must be well defined, and the descending nostrils gently shortened; viewed in profile, the bottom of the nose should not have more than one-third of its length; the nostrils must be pointed below, round, and have, in general, a gentle curve, and be divided into equal parts by the profile of the upper lip; the side or arch of the nose, must be a kind of oval above, it must close well with the arch of the eye-bone, and near the eye must be, at least, half an inch in breadth. Such a nose is of more worth than a kingdom." Numbers of great and excellent men have flourished in all ages of the world, whose noses would suffer much by comparison with *Lavater's* description of a nose, more valuable to the possessor than the worth of an extensive empire: indeed he is compelled to acknowledge this indisputable fact, and observes, that he has seen persons endowed with purity of mind, noble in their conceptions, and capable of exertion, whose noses were small, and the arches of their profiles inverted; and yet, true to his principles, he discovered, or imagined he discovered, their worth to consist in the elegant effusions of their imaginations, their learning, or fortitude in suffering; and this is accompanied with a proviso, that the remainder of their form must be correctly organized. We submit, with deference, the physiognomist did not present the above as an essential nasal pattern to any set of features, he only fancifully drew a picture of what he thought would be a perfect nose.

Noses arched under the forehead belong to those who possess the energy to command, are capable of ruling,

acting, overcoming, or destroying others; rectilinear are the medium between the extremes above noticed, and are appropriated by nature to persons who act and suffer with equal power and patience.

Socrates, Larresse, and Boerhaave, were great men, and had ill shaped noses, and were distinguished for meekness and gentleness. Were it possible to attribute an universal prevalence of disposition to a general form of the nose, individuals of every nation would be found who would resemble the Tartars, who have flat and indented noses, the Negroes who have broad, the Jews who have high arched noses: in their propensities it would follow, that whatever qualities the physiognomist may apply to these individuals, must also belong to the whole people whose noses bear a resemblance to them. Were this particular accurately examined into, it would tend in a measure to prove the correctness or detect the fallacy of the science, as hitherto practised.

Mouth.—The admirers of this study attribute great powers to the mouth, in expressing the emanations of the mind; and Lavater expatiates on it with enthusiastic fervour indeed. “Whoever,” he exclaims, “internally feels the worth of this member, so inseparable, so well defined, so simple, yet so various; whoever, I say, feels this worth will speak and act with divine wisdom.” He then proceeds to call it, “the chief seat of wisdom and folly, power and debility, virtue and vice, the seat of all love, all hatred, all sincerity, all falsehood, all humility, all pride, all dissimulation, and all truth.” Granting the benevolent pastor full assent to these observations on the mouth, it becomes the indispensable duty of all men to notice the physiognomy or indications of that organ; in making those observations, it will be necessary to examine the lips separately, to ascertain when they are closed, during the moments of perfect tranquillity, whether that operation was performed without a forcible exertion of the muscles, particularly of the middle of the upper and under lips, the bottom of the middle line at each end, and finally the extent of the middle line on both sides. The character of the man is proclaimed in the lips, the more firm the latter, the more fixed the former; the weak and irresolute man has weak lips, with rapidity in their motion; the vicious, cringing, mean, and vile, has a countenance, with lips and other members of the face, never well formed or justly proportioned to the other parts of his visage, and the line of which is equally serpentine on either side: such,

though they may denote a tendency to sensuality, belong exclusively to a good character, deserving of admiration in most relations of life.

A mouth, the lips whereof are so thin as to present at first view little more than a line, is a prognostic of apathy, yet quiet, very industrious when stimulated. When this description of mouth is raised at the extremities, vanity, or vain pretensions, affectation, and probably deliberate malice, distinguish those so formed. The opposites of this kind, are those lips swelled into a considerable size, which denote indolence and sensuality. The *cut-through-sharp* lip, as *Lavater*, or at least his translator, terms it, has to contend with avarice and anxiety. Lips closed accurately without exertion, and handsome in the outline, belong to the exercise of discretion and firmness. Lips with the latter advantage, and the upper projecting, are generally appropriated to the virtuous and benevolent; though there are, without doubt, numberless persons of excellent characters whose under lips project. But in *Lavater's* opinion, the last peculiarity implies a well meaning man, whose goodness consists rather of cold fidelity, than ardent friendship. The under lip, hollowed in the middle, denotes a fanciful character. Let the moment be remarked when the conceit of the jocular man descends to his lips, and it will be seen to be a little hollow in the middle.

The mouth naturally closed, invariably signifies fortitude and courage. While the latter quality is in agitation the mouth closes insensibly. The naturally open mouth marks a disposition to complain; the closed, on the contrary, denotes endurance. Though physiognomists, adds *Lavater*, have as yet but little noticed these particulars, yet much might be said concerning the lips improper, or fleshy covering of the upper teeth, on which anatomists have not, to his knowledge, yet bestowed any name, and which may be called the curtain, or *pallium*, extending from the bedding of the nose to the red upper lip proper. If the upper lip improper, be long, the proper is always short; if it be short and hollow, the proper will be long and curved: another certain demonstration of the conformity of the human countenance. Hollow upper lips are much less common, than flat and perpendicular; the character they denote is equally uncommon.

Teeth.—The ancients who studied the physiognomy of man, supposed that diminutive short teeth betrayed the weakness of those who possessed them; more modern ob-

servers contradict the supposition, and declare that men of uncommon strength have such; but they are rarely of that pure white, so necessary to preserve the general beauty of the countenance. Teeth of usual length and *narrow*, are signs of weakness and cowardice. Those justly proportioned to each other, white, and transparent, which appear immediately upon opening of the lips, though not projecting, and entirely exposed to view from the insertion on the first opening of the mouth, are seldom to be met with in the jaws of persons who possess unamiable propensities; when teeth of a different description are discovered belonging to amiable and worthy characters, inquiry will greatly satisfy the physiognomist that his conclusions on this head were just; and that the blackness and derangement were occasioned by disease.

“ In one way the observer and admirer of this art cannot possibly be mistaken, for he who neglects his teeth, suffering them to decay through contempt of public opinion and indolence, may be safely pronounced an unhappy character, with many evil propensities.”

The chin alone remains to be noticed in this slight survey of the human face, as connected with the internal operations of the soul or mind.

The *Chin*, when prominent, is said to mark something decided; and the receding the reverse; and it has been asserted, that the presence or absence of strength is frequently demonstrated by the form of this part of the countenance: it has been also said, that sudden indentings in the midst of the chin are peculiar to men of excellent cool understandings, unless attended by marks of a contrary tendency. When the chin is pointed, the possessor is supposed to be penetrating and cunning; and here again the chin offers a certain criterion to the physiognomist, who may securely pronounce a large, fat, double chin an appendage to gluttony. Flatness of chin speaks the cold and dry; smallness, fear; and roundness, with a dimple, benevolence.

“ No one,” says *Lavater*, “ whose person is not well formed, can become a good physiognomist. Those painters were the best whose persons were the handsomest. *Rubens*, *Vandyke*, and *Raphael*, possessing these gradations of beauty, possessed these gradations of the genius in painting.”

“ The physiognomists of the greatest,” we conceive most correct physiognomy themselves, is meant, “ whose sym-

metry are the best. As the most virtuous can best determine on virtue, so can the most handsome countenances on the goodness, beauty, and noble traits of the human countenance; and, consequently, its defects and ignoble properties. The scarcity of human beauty, is the reason why physiognomy, so desirous to be known, finds so many opponents; no person, therefore, ought to enter the sanctuary of physiognomy, who has a debased mind, an ill-formed forehead, a blinking eye, or a distorted mouth.”¹

“ The light of the body is the eye; if, therefore, thine eye be single, thy whole body shall be full of light; but if thine eye be evil, thy whole body shall be full of darkness: if, therefore, the light that be in thee be darkness, how great is that darkness?”

We have given large extracts from the copious and expensive work of that author, J. C. Lavater, on physiognomy, in order to enable our readers to judge for themselves.

The science we believe to be founded in nature; but cannot, in justice to our own discrimination, suffer those extracts to escape us, without observing that we believe with much truth and sagacious remark there is mixed also much extraneous matter; some, and particularly the last remark, even below decency and mediocrity, even verging upon childish puerility.

CRANIOLOGY assumes its name from the object it examines, and is the doctrine of Dr. Gall upon the human *cranium*, or skull,—its mode of formation, structure, and peculiarities. That gentleman thinks, from its connexion with the brain, to which it is a covering, it has a decided influence upon the seat of thought, and even upon thoughts themselves, and the general disposition of the mind; and hence becomes susceptible of definition.

This doctrine being of much more recent date than that of physiognomy, according to the usual undecided and uncertain state of public opinion, it is yet in a state of suspense between adoption and discredit, or reception and neglect. With an intention to be serviceable to the interests of science, and at the same time to gratify the inquiring disposition of the public mind, we subjoin the following particulars.

The inventor is, we understand, a physician, of considerable practice and much esteem in Vienna: natural history, collecting various plants, animals, &c. we have been in-

¹ See the opinion of Socrates on beauty, in vol. i. article *Statuary*.

formed, distinguished the bias of his mind, from earliest infancy; always employed in classing, and delighted with comparing the various works of nature. He was peculiarly attentive to the heads of objects, their shape and utility; and whilst in a course of instruction, was ever remarking on the heads of his play-fellows and fellow students, on their moral and intellectual character; from various traces of resemblance, he judged of dispositions. As he grew up, he fixed on medicine to be his profession, and was led by an impulse, which he considers the result of his organization to the habit of observation and comparison. He employed much time in making a large collection of skulls of dead objects, as well human, as of other animals for the sake of comparison; he also had the copies of many living skulls taken in gypsum: so that, eventually, it is said he has made a most valuable collection of these subjects. Dr. Gall soon discovered that the general inferences he had drawn from these observations, would not at all times bear him out; he was, consequently, compelled to be more precise in his observations, when he discovered less inconsistency in subsequent remarks. He likewise discovered considerable solicitude, at the first, to affix a proper and characteristic name to local organs, when he often discovered change of local situation necessary. At length surmounting these and various other obstacles which continually present themselves in opposition to the progress of any thing which has not been taught in the nursery; among these, he had to combat with the power of ignorant priests, and a slavish court under their guidance and controul; but, at length, he was permitted to deliver lectures to *foreigners* upon this newly discovered science: the result we have collected and lay before the public.

Dr. Gall says he has discovered from the anatomy of the brain, that it is not, as generally considered, a pulpy substance, but that it is of the nature of a membrane, in some places not a line in thickness. He was first led to consider this subject with attention, from a knowledge that the member has been repeatedly suffering from cases of *hydro-cephalus internus*, where a large quantity of water is occasionally collected in the ventricles; and the brain becomes distended to a membrane not of the thickness of a line; also from a paralysis of the extremities with other partial affections of that member: yet the intellectual faculties remained unimpaired.

The chief results of his anatomical labours were, that

the entirety of the medullary of the *cerebrum* and *cerebellum*, consists of nervous fibres, and the whole of the cortical substance of *ganglions*, by means of which the nervous fibres are nourished, strengthened, and more intimately connected. That the nerves, which constitute the essential part of the *cerebrum* and *cerebellum*, as well as of the spinal marrow, are like blood vessels, of two kinds, the excurrent, or diverging, and recurrent, or converging, which all arise from the spinal marrow, or terminate in it; consequently, that the origin of the medullary substance of the *cerebrum* and *cerebellum* is derived from the spinal marrow. That the cortical substance is the superficial ganglion of the *cerebrum* and *cerebellum*; and that all the excurrent nerves terminate in the outer surface of the cortical substance, on which the pia mater rests, and all the recurrent nerves take their origin in that place.

Prior anatomists have supported the reverse of Gall's discoveries; they believing the *medulla oblongata*, the *medulla spinalis*, and the *pons varolii*, are formed by elongations of the substance composing the *cerebrum* and *cerebellum*. Waller declares there is no truth in what Gall pretends to have discovered; that the preparations he displayed, and the structure described, are only the fictions of his own fancy; and protests he saw nothing of what was said to be so clearly proved; whilst others, equally capable of judging, and perhaps more quick-sighted, not only saw what Dr. Gall proposed to show, but evidence their opinion in justice to his observations. Bischoff has written in his defence, and amongst others, adduces the names of two of the most respectable men in the University of Halle, *Loder* and *Reil*, to support Dr. Gall's claim to truth and the accuracy of his description; which Loder himself has also declared, where he expresseth himself in terms of great praise and high commendation, communicates a case in point to illustrate Gall's position; but at the same time laments the paucity of facts to confirm the theory.

It is in the hands of men well qualified to judge of its truth; and by their skill, and from their experience it must either stand or fall.

The brain has been generally believed to be the seat of all nervous sensation, as well as the origin of thought; but the term thinking is supposed to be too general an expression, when the intellectual phænomena of thought includes a vast variety of specific particulars; and the term brain, expressing a very complicated organ. Gall inquires if we shall rest content with the general assertion, that the brain is

the organ of mind? or shall we not rather look more narrowly into its structure, and see if we cannot consider a part in relation to some specific portion of the mind? parts, which he alleges, may be shown to be anatomically distinct, in exactly the same manner as the brain was formerly considered. He adds, “we shall on such inquiry discover, and by this more minute research, that it is but in a rational pursuit of the inquiry suggested on the first general observation.” Dr. Gall then professes to have made this inquiry, and to have found that we ought not to content ourselves with considering the brain as the organ of thought, but as a congerie of distinct organs; the existence of which, alone renders that great diversity and infinite variety of talent possible, which are known to distinguish the various individuals of the human race from each other, not more than they themselves are rendered distinct from other objects in the creation. Each of these nervous streaks we observe in the brain, will be discovered to make a particular circumvolution of the hemispheres, and should be considered, Dr. Gall alleges, as an organ of some particular function of the mind; *i.e.* that each streak, or duct, should be regarded as a portion upon which the mind operates according to some certain and determined degree of force; and its structure being so organized, as to receive the impressions communicated to it. The following consideration, in this state of the question, must be regarded of great importance.—“The physiologist has observed in the animal creation, that *the nerves of those animals which are distinguished for smelling, seeing, hearing, &c.* are marked for being *numerous and large*, evincing a more elaborate developement. And being accustomed to see the olfactory, optic, and auditory nerves in animals proportionally large to the perfection of the senses they severally furnish the individual with.” Whence, he draws the general inference, that, whenever any organ is found in a higher state of developement, then we may expect to find the power dependent on it in a corresponding degree of energy. “But,” he prudently and with justice adds, “the living brain never being exposed to observation, and from the nature of its substance, to see much of its form and texture soon after the death of the subject;” the inference of the physiologist concerning the organs of the brain, would therefore avail but little, unless some certain connexion were ascertained between the brain and the skull. This connexion is asserted in the following fundamental position:—“That the internal lamina of the skull, is, during the life of man, perpetually forming

by the brain itself; and that, therefore, when the external and internal plates of the skull run parallel, we may infer the form of the brain from the outward shape of the skull."

Upon this fact, and the before alleged circumstance of the circuvolutions of the *cerebrum*, consisting of an organ of some *intellectual*, or *sensible power*; the greater size, or larger developements of which, of course give the skull its peculiar shape. Upon this rests the sciences of *Craniology* and *Cranioscopy*; the one asserts the shape of the skull, indicates the law by which, not the *actual* character, but only the *tendency* or *disposition* of the object towards some definite and recognised propensity exists; the other affirming that such law can be visibly ascertained upon inspection of the skull of the individual so distinguished.

In the infancy of any science it certainly behoves the inventor to act with extreme caution,—such precaution is adopted by Dr. Gall, when he says,—“We are not to expect to perceive the already developed faculty of the mind, by mere observations made on the skull; it is the *tendency* only, or *aptitude*, or *possibility of any particular intellectual quality* in any individual that *can be discovered*; and besides, all the *predispositions cannot* be selected, because *many* of the supposed organs *cannot* influence the shape of the bones, in consequence of their *remote situations*.” Hence, all the organs, and consequently the predispositions, in both animals and men, are said to be innate and more latent, perhaps, with respect to their greater portion.

The functions of the brain are said to be threefold: first, organic life; second, sensitive life; and third, intellectual life. A particular part of the brain is assigned to each of those functions. It is only in consequence of the size of these hemispheres, and the part appropriated to the last of these functions,—that man has the largest brain; and not because the size of the human brain is greater than the rest of the body, as has been supposed; nor on account of the comparative thickness of the nerves, as Sommering has observed. To prove that the organs of thought are placed in the hemispheres of the brain, those parts are said to be of larger size, and more completely developed in animals of different classes, in proportion to their intellectual faculties; and in man they are most perfect.

The arguments adduced by Dr. Gall, in proof of the plurality of organs in the brain, are, 1st. The sense of fatigue, arising from the mind being long employed on one specific object of contemplation; that sense of relief it ex-

periences from variety. 2dly. The various degrees in which the different faculties are possessed by the same individual. And, 3dly. The loss of certain faculties and powers of the mind from disease, or accident, affecting certain parts of the brain; whilst those peculiar to other parts are retained.

The rules of observation by which Dr. Gall challenges the public, and the profession in particular, to try his statements, may be of some service: he having faith in the uniformity of nature, and trusting that what he has long seen may be remarked by others. 1st. By close observation on living persons in a state of health, carefully feeling, and correctly noting the eminences of the skull; each of which, he considers an organ, or at least as enveloping one; and using that term *contiens pro contenta*; considering that only as skull which immediately covers the brain.

Proceeding in his observations, Dr. Gall has discovered, that individuals, eminent for certain talents, have certain local eminences in some definite part of the skull; whilst others are in the same part rather depressed. He recommends the experiment not to be made upon persons without their being eminent for some distinct talent, or who have strong peculiarities of mind. In feeling for those organs, he advises that the palm of the hand be used in preference to any other part. 2d. As some of the organs lie at the base of the skull, the fact cannot be ascertained till after death. 3d. The observations on persons during a state of mental disease, will be found peculiarly serviceable to discover whence it proceeds.

Insanity is confessed to be a disease of the brain. Dr. Gall thinks one part of the brain may be diseased, and another in a state of health, or at least comparatively so; the whole brain is thought, must be *dangerous*, by a person who objects to his system, on the ground of the want of confidence in a person who is a lunatic, or partially insane. But Dr. Gall asserts a possibility at all times to discover the organ from whence the disease proceeds; and also recommends practice for its removal.

The separate organs in the skull of man, and of which Dr. Gall claims the discovery, are in number twenty-six; which he divides into three classes.

Class I.—Comprehends those by which man is enabled to enter into commerce with the world which surrounds him. The 1st of which he considers the organ of sexual love; at the lower and back part of the head. 2d. The organ of parental and filial love, and the animal *storge*, at the

upper part of the *occiput*. 3d. The organ of friendship and fidelity, between the ear and back of the head. 4th. The organ of fighting, a little above and below the ear. 5th. The organ of slaughter lies a little before and above the preceding organ of fighting. 6th. That of address, or cunning, is before and above the latter, and is seated in the spheroid angle of the parietal bone. 7th. That of cupidity, is the organ of address continued almost to the eyes. 8th. Of good-nature, in the centre of the upper part of the forehead. 9th. Of mimicry, or imitation, at the side of the organ of good-nature. 10th. Of vain-glory or vanity, at the back of the parietal bone. 11th. Of constancy, or firmness, in the middle of the top of the skull, where the frontal angles of the parietal bones meet.

II.—The second class of organs comprehend those by which we are enabled to acquire a more familiar acquaintance with objects, known to us by means of the external senses. 12th. Organ of aptness to learn and retain things, over the root of the nose, between the two eye-brows, and above the glabella. 13th. Of aptness to learn and retain places, fills that half of the eye-brow which is towards the nose. 14th. Of aptness to recollect persons, (doubtful,) at the upper part of the inner side of the orbit. 15th. Of the sense of colour, lies in the superciliary arch, on the outside of the organ of taste. 16th. Of aptness to learn and retain music, above and behind the exterior angle of the eye, where it adjoins the organ of cupidity. 17th. Of aptness to learn and retain numbers, is placed on the outside of the organ of music, at the extreme end of the arch of the eyebrow, and the exterior upper angle of the orbit of the eye. 18th. Of aptness to learn and retain words, at the upper and back part of the orbit, producing what is commonly called a goggle-eye. 19th. Of aptness to learn and retain languages, on the upper and anterior part of the orbit, so as to depress the eye, and make it appear rather hanging than prominent. 20th. Of mechanic arts, behind the organ of number, and below the point where the organ of music and cupidity meet. 21st. Of prudence and circumspection, about the middle or side of the head, or nearly in the centre of the parietal bone. 22d. Of loftiness, at the back of the top of the head, *i. e.* at the posterior part of the sagittal future.

III.—The third and last class of organs, are those which constitute the peculiar prerogatives and glory of the human race, and which more eminently raise man above the brute creation. They all lie on the crown of the head, or on the

forehead, that august feature, which the poet considers as the glorious characteristic of humanity. The forehead rises in animals as they are advanced in the scale of intellect, but it is in man alone that the front assumes that graceful swell, which is no less beautiful to the eye of taste, than significant to the physiognomist. 23d. The organ of rhetorical acuteness lies on the middle of the forehead, above the organ of thinking and beneath that of good nature. These three organs follow each other; therefore, in a straight line, from the gabella to the sagittal future. 24th. Of metaphysical subtlety, on each side of that of rhetorical acuteness; so that when strongly marked by the law organ, an appearance of a prominent round swelling is formed. 25th. Of wit, at the outside of the last mentioned organ. 26th. Of theosophy, in the centre of the top of the forehead.

It is not our intention to enter into a detail of those organs as given by the author of the invention. We propose to transcribe the remarks upon some few of them only, as we find them in a work of merit, to furnish a general idea of the proof, and as an illustration on which the theory of cranioscopy is established.

“ The organ of sexual love is placed in the cerebellum. It comprises that part of the *occiput*, which lies below the *linea semicircularis inferior* towards the great occipital hole; and in living subjects, therefore, it is to be judged of by the thickness and breadth of the throat and neck. It appears double on the skull, though the two organs and eminences of the cerebellum join each other, and produce a swelling apart on the skull, occasioned by the *crista occipitalis interna*, which lie between them. As the sexual passion rises in the subject, this part of the brain grows in disproportion to the other parts; but when by castration, the purposes of nature in its formation are defeated, it ceases to develope and perfect itself. In those men and animals who have suffered this operation, whilst young, it may be observed, the back part of the skull ceases to grow, the neck becomes narrow, and the voice, whose seat is in the throat, loses its manly vigour.

This remark applies to many species of animals. In the more simply formed animals, as well as in certain insects, which generate in the usual way, the whole mass of brain consists of mere knots in appearance, which are, as it were, the commencement of the cerebellum; while, in other animals, which do not procreate in the usual way, those knots are wanting. The stallion and bull have a more perfectly developed cerebellum, and, consequently, have a thicker

neck and broader head behind, than the gelding or the ox. This is obvious to persons engaged in husbandry and riding horses, who give a preference to those stallions whose ears stand widest apart. The male mule, which has no power of procreation, generally speaking, has a very narrow neck, and the ears stand close together. It is further observed, the horns of the ox are much larger than those of the bull, for the reason previously mentioned, that ossification increases in the proportion the brain diminishes. Upon the same principle, the growth of the horns of the stag are governed. If, at the time of rutting, this animal has its horns cut off, it loses its power of procreation till they grow again. The channel of its generative faculty is turned aside, and till that is recovered, it does not return.

Through the whole class of quadrupeds, the neck of the male is thicker than that of the female. Dr. Gall attributes that to the longer duration of the sexual appetite in the male than the female. There are many phænomena in cases of disease which tend to the same conclusion. In the *nymphonia*, for instance, Dr. Gall has found a lady of rank and character in Vienna, subject to the most violent attacks. She was frequently seized with convulsive agony, the strongest affections in her neck, and in a sort of madness would violently knock the back of her head against her back and shoulders, till by efforts like these she obtained a discharge of the matter which was the origin of her complaint. Wounds in the head and back of the neck, will inflame the generative organs, and sometimes produce impotency.

In nervous fevers, satyriasis is not merely a local disease, but a general evil of the whole nervous system, and should be removed by such remedies as afford the nerves relief. This, the Doctor says, seems to intimate the participation of the brain in generation.

The cases of *hydrops cerebi* are also in favour of the same doctrine. It is found that of all the general functions of the brain, that of generation is often the only one which remains undisturbed, and, for a well known cause, the cerebellum suffers least of all parts of the brain. But a sufficiency of cases to prove this position have been given.

The organ of aptness to learn and retain places, has the following observations made upon it.

He says, this organ is apparent in various birds of passage, as swallows and storks, pigeons, which are letter-carriers, dogs, &c. He relates an anecdote of a dog carried from Vienna to London, that returned to the port, took his

passage in a ship in which was a gentleman who travelled to Mentz, from whence the dog went to Vienna.

In men, he says, this organ appears to operate variously, but in every case is connected with a disposition to observe the relations of space, and produces a delight and peculiar ability in those occupations which depend upon relations. For instance, both Marshal *Laudon* and General *Mack* are distinguished by this organ, and both these Generals are said to possess, in an eminent degree, that important part of the duty of a commander-in-chief, which lies in the skilful disposition of troops in the field, the geometry of war. It generates the love of travelling: after the Doctor had formed his opinion of this organ, he was struck by meeting a woman of low rank in the streets of Vienna, on whose forehead this organ was so strikingly marked, that he procured a cast of her head, and inquired of her her way of life: she informed him that at sixteen she ran away from *Munich* to *Vienna*, where she lived not as a servant at one place, for she could not remain in any situation long enough, but went from inn to inn; where her inclination to see change was best gratified. The portraits and busts of the most eminent travellers and navigators are marked strongly by this organ. Capt. *Cook* is said to have been so distinguished.

The arguments adduced against Dr. Gall's theories are few, weak, and groundless, in our opinion. It will be easy to exhibit the futilities of the first, in which the writer objects to his first position, the sense of relief afforded by a change of study. A single question in our turn will settle this point: and we appeal to the good sense of our readers to answer whether, *in fact, it is, or is not so?* The second objection alleged against it is, the assertion of some one part of the brain having received injury, and the other was not affected by it. This is a positive fact which has come within the cognizance of our own knowledge.

The other arguments we have seen used against it are all equally weak and unavailing. Much, by-the-bye, is said about his analogy of comparison; now it strikes us, that his analogical resemblances are close and just; and indeed so would the writer we comment upon himself have seen, had it answered his views.

It, assuredly, is but fair to give it a chance, to collect arguments and instances in its favour, particularly, as it can injure no one; and it is probable the cultivation may be beneficial to some, and particularly in the way of supplying facts for improvement in medicinal cures.

PAINTING.

Its original is to be traced up to that known source, from whence most of those arts which humanize society and lend a polish to life first had being. It will be recollected, that in one of the preceding articles, where the first astronomical observations are mentioned, a passage in Diodorus Siculus is quoted, where he speaks of bricks burnt in the fire with various colours, representing the natural appearance of men and animals; which is the first fact upon record. As this occurred on the building of Babylon, it is as remote an original as we are, perhaps, authorized to depend upon; although it is extremely probable it might be traced to an anterior date: which conclusion though made from inference alone, we are allowed to suppose must of necessity have been the case; as a knowledge of the nature of pigments must first have been ascertained before the Chaldæan artists could have been informed what colours would fade, or what would withstand the operation of the enamelling process in the intense heat necessary to produce the effect. They must, at least, have understood the difference between vegetable colours, which are the first presented to the senses, and most probably were the first which were used, and those afforded by the mineral kingdom, which alone were proper for the operation they performed. Therefore the arts of painting and chymistry, we should presume, must have made considerable progress anterior to the erection of that tower.

The next people, who in point of time as well as of importance, offer themselves to the notice of modern Europeans, are the Egyptians; and their perfection in the use of the various colours which constitute the compound idea we entertain when we think of painting, is well known and appreciated; when we may any day consult our judgment by inspecting those beautiful specimens of their eternal mode of colouring, we have in the exhibition on mummy-cases in the *British Museum*, and other depositories of that species of antique preservation. The third people who excelled in giving a beautiful and tasteful variety to surfaces in colouring and effect, were the *Etrurians*, or *Hetrurians*, a people anciently inhabiting a district of Italy, now known as TUSCANY. Of the perfection to which they brought the art, we may form an adequate and proper judgment by inspecting those beautiful vases preserved in the *Hamiltonian* collection, in the *British Museum*, and also in

some very curious specimens of ancient painting, procured from the ruins of Herculaneum, collected by the same ingenious and tasteful gentleman, Sir William Hamilton, deposited in the Ante-room to the Hamiltonian collection, and in glass cases at the upper end of the same collection. It cannot be doubted, that most distinct societies of men have, after the gratification of their first wants, and when leisure hours permitted the exercise of the ingenious and inventive faculties, invented a great variety of useful and ornamental arts; therefore, there cannot be a question, but various arts of utility as well as ornament, have been invented by a great variety of people; who all, agreeably to our anterior definitions, are well entitled to the distinct appellation of original inventors: consequently, in such a case, the question must evidently submit to the determination of chronology. The most original being alone to be determined by its aid, in that space of the continuity of time, marked by days and years. The preceding observation we have often in effect found necessary to introduce to the notice of our readers.

Here it becomes peculiarly essential to present the name of her, who is first elegantly presumed to have introduced the art into Greece,¹ by a most respectable literary lady, Mrs. Opie, who attributes it to the daughter of a potter of Corinth, named Eudora; which invention is become doubly interesting, first, because of its elegance and utility; and secondly, because it is ascribed to one of the noblest and most powerful passions which distinguish the human species, the wonderful effects of which have given to humanity the most exalted and illustrious of actions which ennoble the character of man,—to delicate, refined, and almighty sexual love. Numerous artists in the Grecian school brought the art of painting to great perfection, as we are informed; but since its materials are not so durable as are enamelling or statuary, we, the moderns, have no opportunity to satisfy our own judgment of the truth of those relations, as we have in those arts; but it is reported, that there were many eminent artists in Greece; nor should the names of *Xeuxis* and *Apelles*, and numerous other artists of that school be omitted, did our limits permit; the latter of whom, we are informed, used only four colours, white,

¹ The art of painting in Greece, as to its original, is, we understand, also claimed by Sicyon and Corinth. Mr. Fuseli has beautifully observed, in his first lecture illustrative of the latter, that “If ever legend deserved our belief, the amorous tale of the Corinthian maid, who traced the shadow of her departing lover by the secret lamp, appeals to our sympathy to grant it.”

yellow, red, and black, with which he is reported to have made the most beautiful productions.

The restorer of this delightful art in Europe, was Cimabue, a native of Italy, who first studied under some Grecian artists, and furnished some admirable productions in *fresco* in several Italian churches, about the period of the renovation of the arts in modern Italy. Since which time, this purely intellectual art has been successfully cultivated in almost all countries in Europe, certain masters in all the schools of which have been eminent for some peculiar excellency.

An analogy by comparison has been drawn between the fascinating effect of music on the ear and colour on the eye, wherein it is observed the comparison very nearly approximates; whence the term *harmony*, applied to the former, may correctly and with singular propriety be used when speaking of the latter. And also, it is said, for the same reason and proceeding upon the like analogy, the term *tone* is also applicable to both: they are accordingly used indiscriminately. Without questioning their propriety, we give in to our sensations, and as far as our judgment goes, believe they are not improperly introduced into the pictural art.

It cannot be presumed that we should have the temerity to aspire to the task of giving a full and complete description of every variety which constitutes perfection in the art; for this would be to infer professional ability equal, or, perhaps, superior to what any one individual ever was known to possess. Besides this inference, another must be presumed, because perfection in description must also anticipate the most delicate, refined, and, as termed, classically correct taste; neither to these do we assume the possession of such well known essentials as are positively necessary to its formation. It is, besides, altogether difficult, as the world acknowledges, to fix a standard to the ideal faculty of taste, and which we have before had occasion to notice.

To attain the previously enumerated essential requisites, the longest life, the best professional education, and the most ample means of obtaining every information on these subjects, would be scarcely sufficient. Also when we consider that whatever can be said upon these subjects, has been already so much better given by others, whom the public have already before them; that the observations we have already made shall suffice for the present occasion.

ENGRAVING.

Engraving on Wood and Copper for Pictural Representation, are both modern inventions; the former was invented, as we are informed, by *Albert Durer*, about the year 1520. It has since been in various stages progressively improved, at different periods; but few have attained the exquisite perfection to which it is at present brought by the eminent Mr. *Bewick*, as his various productions, and particularly a recent publication on natural history, will evince. Nor must the tribute of our admiration be withholden from Messrs. *Branston* and *White*, in this line, as a recent cabinet edition of *Shakspeare* will fully prove their decided superiority.

The process of engraving on *wood* is diametrically distinct and opposite to that of engraving on *copper*: as in the former, the shades are produced by the parts of the work which are made most prominent, and obtrude unto the surface of the substance; whence, its chief merit has been regarded in leaving broad and well proportioned lights. The parts to produce this effect being of necessity excavated, great art and a masterly judgment are requisite to effect this, and at the same time not to weaken the substance, lest it should be injured in the pressure necessary to obtain an impression.

The substance usually employed for these engravings is wood of a close grain; whence box-wood, in general, is selected. The impressions are obtained from wood engravings upon exactly the same principle as are the impressions from typography; and they can also be worked off at the same moment and in the same *chase*, or rectangular frame, in which the letters of a page are fixed. This is a superiority which wood engraving possesses over copper, and recommends itself to publishers on account of the saving in expense of a double process in procuring copper-plate impressions in typographical works.

The art of engraving on copper-plates, for impressions, is alleged to have been originally invented by *Peter Schoeffer*, an early printer, about 1450, the son-in-law of *Faustus*, or *Faust*, of Mentz. Although we are not ignorant that it is claimed by a Florentine goldsmith, of the name of *Finguires*, in 1640; who, having used liquid sulphur to take an impression of some chasing and engraving he had made, observed a blackness produced by the sulphur, left in the

deepest parts of his work ; whence he obtained an impression on paper.

The reason why we give the preference to Schoeffer is, because some of the books printed by him are ornamented with head and tail pieces, with other rude attempts at engraving. Schoeffer was a man of much ingenuity ; he first reformed the types used by printers ; and in the stead of the wooden types, or blocks, with which they first printed, he invented cut metallic types, and afterwards introduced the fusil types now employed.

Of engraving there are various species ; that kind called by connoisseurs the legitimate mode of engraving, is what is termed the *line* or *stroke* mode ; of this species the most *valuable* engravings are made. Numerous have been the British artists who have excelled in this style, in affording the means of multiplying our graphical productions. In historical compositions, which stand at the summit of the art, the first, in point of time, and most eminent in his day in this walk of art, we must ever regard Sir *R. Strange* ; and notice a print which will establish his fame, and perhaps our own judgment with the public ; it is an engraving from a design of Rubens, representing *the fraud of Laomedon upon Apollo and Neptune detected, after those deities had built the walls of his city, Troy*.

In *portraits*, the greatest and first improvers were *Houbraken* and *Vertue*. In *landscape*, *Woollet* has scarcely in the present day a compeer.

The value the public place upon the works of the previously named artists is the best criterion of their worth ; believing, with *Butler*, that, generally,

“ The sterling worth of any thing
“ Is just as much as it will bring.”

The next species of engraving which we shall notice, is that department called the stipple, or chalk style,—imitative of chalk drawings. Portraits and historical pieces are executed in this style, which the famous *Bartolozzi* brought to perfection ; *Vandermini* and *Cardon* also excelled in its character.

The third species we shall notice cannot properly be called engraving ; the effect is produced by scraping and rubbing ; this kind is called *chiaro oscuro*, or mezzotinto ; producing prints which have the effect of Indian ink drawings. In this species of execution the late *Valentine Green* was deservedly eminent.

A fourth species of engraving is what is commonly used

for landscapes alone, which produces an effect like a pencil water-colour drawing. This kind is called *aquatinta*.

In all which species of engraving upon copper, the artists find the *sulphuric acid*, or *aquafortis*, a most powerful agent. Sometimes, indeed, it is suffered to execute the whole of the process of the graver,—when it is called an *etching*; in which *Cabot* and *Woorlidge* are deservedly eminent.

We shall abstain from naming the many very eminent British engravers now living, for obvious reasons. However, the scarcity of good engravers on wood afforded the opportunity to use, perhaps, a stimulus to create others in this very useful art.

We have innumerable artists eminent in every branch of these arts, in which this kingdom particularly excels the neighbouring nations. Except, indeed, one engraver, who executes the designs of the famous statuary and draughtsman, *Canova*, we know of none, from what we have seen, which can be classed with artists of the British school. The works of this artist possess the most happy imitation of marble, in *statuary*, we have ever beheld.

We have already observed the mode of obtaining similar effects from wood and copper, are opposite to each other. The mode by which impressions from wood are obtained, has been noticed; and it now remains that we observe upon that by which impressions are procured from copper. The plate is covered with appropriate ink; the surface is then carefully cleaned, leaving ink only in the excavations or lines in the copper. The plate and paper, with a blanket, are passed through a roller press of great power: the paper being impressed into the remotest crevices of the plate, brings away the ink there deposited.

PRINTING.

Should we except the claims made by the *Chinese*, who are alleged to have invented *printing*, in their mode of execution, with numerous other European arts, for an immense number of years before such arts were thought of in Europe: and they claim printing in particular; but their mode of printing is upon the principle which calico printers print their furniture, and not analagous to that used by card manufacturers, as some have asserted: but if we except these Asiatics, it will then appear that the ancient Romans

had, *in effect*, invented this art, in an early period of their existence, from the subsequent statement.

There is now in the possession of *His Grace the Duke of Richmond*, an antique *forma literarum*, similar to the description of *Cicero* in his “*De Natura Deorum*,” it being made of metal, *i.e.* a species of Roman brass; the ground of which is covered with the rust which antiquarians call *ærugeo*, a green sort of verdigrise rust, with which antique medals are usually covered. The letters rise flush up to the elevation of the exterior rim which surrounds it. Its dimensions are about two inches long, by one inch broad, bearing the name of

CAIVS JULIVS
CÆCILIVS HERMIAS

At the back of it is a small ring for the finger, to promote the convenience of holding it. This is presumed to have been the name of some private individual, and to have been just dipped in common writing ink, or any coloured fluid, when it would save the trouble of writing the name.

We have often had occasion to express our feelings in grateful eulogium, when considering the benefits resulting to the human species from numerous ingenious discoveries; but when we reflect upon the benefits produced from the typographic art, it appears like a vortex, drawing every other sensation into its deep interest, and engulphing every consideration, so that we can think of printing only, and its large catalogue of various benefits. This interest is wonderfully increased, whether it be viewed on the score of its ingenuity, the extent of its benefits, or the benevolence of its object. In whatever point of view we behold it, whether as a medium for giving the utmost facility to the despatch of the common concerns of life; or as affording the eager mind of the philosophic inquirer the ready means to gratify the inquisitive thirst of his interrogative inquiries in the anxious pursuit of knowledge; in every species of mental intelligence, the rapid facility which it affords to the multiplication of those mediums of communication, by which knowledge is promulgated in every part of the earth. We are at a loss for a term sufficiently comprehensive to express our sense of the infinite importance of those

advantages which accrue to the human species from the invention of arts so replete with important consequences to man, which we hourly perceive to emanate from typography.

Ever since the typographic art has been introduced into modern Europe in its present form, the best, and one of the most certain criterions which prove the indubitable sense of our species, exists in the multiplicity of claims which have been made by several cities for the honour of affording the earliest shelter to the infancy of this art. It really appears to be a question yet undecided, to what city, individual, and even era to attribute this beneficial invention.

However, there is every reason to believe, that in this art, as well as in most others, the improvements which have subsequently taken place, have benefited the art *itself*, as much as *that* has benefited mankind: therefore the question of its origin may not be of so much importance.

Amidst the noise of various claimants, Mr. Bowyer believes, in his *Origin of Printing*, 2d edit. that this claim is to be adjudged to one of the three cities of *Haerlem*, *Mentz*, or *Strasburg*, of which, it is thought, the first named city has best established her legitimate right; “But it appears,” to use his words, “that all those cities, in a qualified sense, may claim it, considering the improvements they have made upon each other.

The real and original inventor of the modern art of printing, as at first used, and from whence the present improved practice is descended, was one *Laurentius*, of *Haerlem*; who, however, proceeded no farther than to separate wooden cut letters. There is reason to believe that at first, these wooden forms were made upon the principle of the previously described metallic *forma literarum* of the Romans. This *Laurentius* of *Haerlem*, it appears, made his first essay about A.D. 1430; he died ten years afterwards, having first printed the *Horarium*, the *Speculum Belgicum*, and two different editions of *Donatus*.

Some of the types of *Laurentius* were stolen from him by one of his servants, *John Geinsfleisch*, senior, who was a native of *Mentz*, and became the first printer in that city, about 1442. In that year he there published *Alexandri Galli Doctrinale*, and *Petri Hispani Tractatus*. These works were executed with wooden types, cut after the mode of those which he had stolen from his late master: like those of the Chinese and the ancient Roman *forma literarum*. In 1443, *Geinsfleisch*, senior, entered into partnership with *Fust*, *Faust*, or *Faustus*, who supplied money, *Meidenbachius*,

and others. In 1444, they were joined by *John Geinsfleisch*, junior, who was also known by the name of *Guttenburg*, or *Guttemberg*. This Guttemberg, with the aid of his brother John Geinsfleisch, sen. is said to have invented cut metallic types, with which were printed the first edition of the Bible, which appeared in 1450; the completing of it occupied seven or eight years.

The perfecting of this art remained for, and is ascribed to one *Peter Schoeffer*, first the servant, and then the partner and son-in-law of Faustus, who was a very ingenious man. Among others of his inventions and improvements, he originally devised the mode of casting types in distinct letters, or matrices, as now practised. To him is also ascribed the invention of copper-plate engraving for impressions. The first book printed with these improved types, was *Durandi Rationale*, in 1459.

We shall just cast a cursory glance at the various claimants for the honour of this art, whose several claims have engaged the warm attention of several literary characters, without entering into the separate merits of any individual, farther than has been stated; which statement we have selected dispassionately, and to the best of our judgment. John Mentel, of Strasburg, John Guttemberg and John Faust, of Mentz, and L. John Koster, of Haerlem, are those persons who have claimed this honour; to them all it has been by several partizans ascribed. Among their most noisy and strenuous advocates appear, *Mentel*, a physician of *Paris*, who claims for his name-sake of Strasburg; and contends that he first invented the art in 1440; and that in consideration of it, the Emperor, Frederick III. gave him a coat of arms corresponding with it, in 1466. He also adds, that Guttemberg, whom he had taken in as a partner or associate, carried it to Mentz, where he took in Faust as a partner. John Geinsfleisch, a native of Mentz, who was his servant, communicated the art to J. Guttemberg, whom Mentel had employed in making some of his tools; becoming thus possessed of it, they removed to settle at Mentz, where it was perfected with the assistance of Faust.

It is contended that this account appears doubtful, and is even contradicted by the chronicle of *Cologne*, *Trithemius*, and *Wimpeling*. The last named writer expressly says, the art of printing was invented incompletely at Strasburg, by Guttemberg, and perfected at Mentz; where Mentel acquired it from Guttemberg and Faust, and returning to Strasburg about 1445, practised it with one Egglestein.

The inhabitants of Haerlem, with Boxhornius, Scrive-rius, and others, ascribe it to Laurens Jane Koster, or Laurence John Koster, (called Koster, from an official situation which himself and family had sustained in that city,) in the year 1430; adding, that his associate, Guttenberg, stole away his tools while he was at church, and carried them to Mentz, where he set up for the first inventor. This theft has been also, without probability, attributed to his partner Faust; others, again, ascribe it to John Geinsfleisch, senior, one of his servants, in 1441. With those types of Laurence, two small works were printed at Mentz, in 1442. The principal evidence in favour of Haerlem, is *Cornelius*, who had been servant to Laurence, and afterwards a bookbinder in that city. On whose authority, Adrian Junius, M.D. founds his account, which appears to have been drawn up between the years 1562 and 1575, published at Leyden in 1588. The learned *Meerman*, in his *Origines Typographicæ*, 1765, has amply vindicated and confirmed the testimony of Junius to this fact; although he disputes and sufficiently invalidates what that writer has said, with reference to the types used by Koster at Haerlem: these he shows were neither cut or fused metallic types, but separate wooden types.

Munster, Polydore Virgil, Pasquier, and others, will have Guttenberg, or Guttenberg, to have been the inventor of printing, and they add, that he took in Faust and Schoeffer as associates. *Naude*, in his *Muscurat*, espouses the cause of Faustus, and contends that he was the first printer in Europe; that he took in Guttenberg for a partner. His reason for assigning this privilege to Faust is, that the first books that were printed appear to have been all of his impression. For this purpose, he alleges, that it is not probable, if Guttenberg or Koster had possessed a greater or equal share in the invention, they would not have allowed him to engross the whole to himself and his son-in-law, Schoeffer, as he has done, without asserting their own right, or contradicting him.

After every due consideration of the preceding claims, it really appears to stand as we have previously stated it. Wooden block types, the *typi fixi*, were first invented by Laurens Koster, of Haerlem; afterwards he improved this idea by manufacturing cut moveable letters also in wood, *typi mobiles*: and afterwards cut metal types were invented by J. Geinsfleisch, jun. called Guttenberg, his brother J. Geinsfleisch, sen. having brought wooden types from Haerlem to

Mentz, with whom Guttemberg might probably have concurred. The period of this invention must have been about 1442 or 1443; because John Geinsfleisch, sen. came to Mentz in 1441. The Latin Bible, with metallic types, came out in 1450, which must have occupied seven or eight years.

The letters were invented and made by, or by the direction of, P. Schoeffer, Faust's partner and son-in-law, who settled at Mentz, in 1449 or 1450; and having acquired under the two Geinsfleischs the art of cutting types, remedied the inconvenience of this method by casting them, which must have been anterior to 1449. The partnership subsisting between Geinsfleisch and Faust, and the relationship between the latter and Schoeffer, have probably produced the confused conception of ascribing to either one of these parties the joint productions of the whole of them. The books previously referred to in *Naude's* account, are—1st. The *Codex Psalmodum*, printed in 1457, the most ancient book known to be printed with a date or inscription; it is lodged in the Emperor's library at Vienna. 2d. The *Rationale Divinorum Officiorum* of *William Durand*, in the Earl of Pembroke's library, Malinkrot has erroneously supposed this to be the first printed book. 3d. *Catholicon Januensis*, of 1460, now in the King's library. Faust's name is not to this, but it is quite like the following ones where it is. The first printers did not subjoin their names and inscriptions to the end of books before the year 1457. They continued to do this after this period, till Faust died or declined business. 4th. The *Latin Bible*, of 1462, being the second edition, now in the French King's library. 5th. *Tully's Offices*, in 4to. the rest being all folios, in anno 1465 and 1466, for there are copies in the Bodleian, and Corpus Christi College, Oxon, of both these dates. Some have asserted this to be the first printed book. 6th. Other Bibles of 1471. 7th. *St. Augustine's Ciostate Dei*, in 1503. 8th. *Mercurius Trismegistus de Potestate Dei*, in 1503. 9th. *Titus Livium*, 1518, &c.

It may be added to this, that at the end of Livy is a privilege granted by the Emperor Maximilian to Schoeffer, grandson of Faust, for the sole power of printing that author for ten years; and for six years to all the other books he should print thereafter; in consideration of Faust's having invented the art of printing. This privilege is dated 1518, and signed *Jac. Spigel*.

It is observed, that *Erasmus*, in the epistle after that privilege, does not positively aver the fact; he only observes, that the first, or chief inventor of that art, is held to be

J. Faust; in the advertisement to the said book, *Nic. Carbachus* speaks to the same effect, as to the privilege mentioned by *Erasmus*.

Respecting *Guttemberg*, *Mentel*, and *Koster*, *Naunde* remarks, that the person is yet to be born who can say he has ever seen books printed by any of them, before or so early as those of Faust; adds, all that is urged on their behalf, is only founded on false reports, conjectures, probabilities, forged authorities, and the jealousies of cities against one another.

Salmuth, in his additions to *Pancirollus*, cites a public act, by which it appears that Faust, after having invented printing, and sustained the expense a long time on his own footing, at length took in *Guttemberg* as partner, to contribute to the very great expense incurred, by reason of the first books being most of them printed on vellum or parchment, and after the Chinese way.

The advocates for *Koster*, place him in the exact situation in which Faust is described. Mr. *Ellis*, in the *Philosophical Transactions*, alleges *Koster's* books are prior to any of those referred to Faust, even some as early as 1430 and 1432. It appears certain, the citizens of *Haerlem* show printed books of those dates, which agrees so well with what *Theod. Scriverius* and others have left, which leaves Mr. *Ellis* little room to doubt whether the honour of the invention be his or the other's due. All that belongs to Faust, according to this writer, is the honour of establishing the art in a greater lustre and perfection many years after at another place.

It has been observed, that it was the custom with the early printers to print more on vellum than paper. This method was, however, soon changed, and paper was introduced for the major part of the impressions, when a few only were printed on vellum for curiosities, and the purpose of being illuminated.

With regard to the claims of *Strasburg*, it appears, that *Guttemberg* had endeavoured to introduce printing there, but without success. The first actual printers at *Strasburg* were *Mentilius* and *Egglestonius*. There is no proof of a single book having been printed there till after 1462, when the dispersion of the *Mentz* printers in that year, occasioned the art to spread rapidly through Europe. In 1490, it even reached *Constantinople*, where, however, the jealousy of the government has prevented its ever succeeding.

It has been observed by Mr. *Bradford*, and with an appearance of likelihood, that it is not improbable the origin

of typography may be attributed to the effects observed from ancient seals and medals, as the arts of sculpture, dye-sinking, &c. dependent thereon, had long arrived at the zenith of perfection, anterior to the meridian of Roman imperial splendour. The forms of animals, letters, &c. impressed on Grecian and Roman medals, and as we have seen in a former article, (upon *Chaldæan* productions, bricks, *Egyptian* coins, &c.) were in *effect* the same as modern printing, and may be, perhaps, called printing on metals; as the impressions made upon Chaldaic clay, upon the *terra sigillaris*, and subsequently on wax, from their seals, &c. cut in metal, agate, crystal, cornelian, and other precious stones, may be said to be printing upon those substances. Lastly, it evidently appears, the Grecian potters had a mode of impressing characters and figures upon their most finished productions at *Samos*, particularly their *lavatoria*, *sudatoria*, vases, and other curious pieces of fine *Samian* wares, as we have seen many beautiful specimens so impressed in the large collection of our friend Mr. JOHN CRANCH, of Bath. Further, *Dorm. Bernard Montfaucon*, in his *Antiq. Explicat.* gives the figures of many large *sigillæ* of the Romans, in which the names are sunk in *creux*, and in hollow capital letters, which he imagines were used to impress large earthen vessels whilst the clay was soft, particularly those in which the Romans kept their wines. This very learned and diligent antiquary never appears to have met with any of those *sigillæ*, like the one previously described, as belonging to his Grace of Rutland, or he would not have failed to have mentioned it.

The ancient printers used the same name for their first forms, as were used by the Romans for similar purposes; they called their printing blocks, in which the letters were immoveable, *typi fixi*, somewhat resembling *stereotype*; whilst those where the letters could be changed, they denominated *typi mobiles*, the same as are said to have been used in ancient Rome, and also similar to the present letters. *Cicero*, in his work before cited, directs the letters to be made of metal; he calls them *forma literarum*, the express words used by the first printers to denote theirs.

The Haerlem book, called *Catholicon*, and those previously mentioned in the Bodleian, and also one in Ben'et College, Cambridge, were printed the same, it has been conjectured, as modern playing cards are manufactured; but we think without sufficient authority. These specimens are unquestionably the very primitive mode of printing we possess, when they were printed upon one side of a sheet

only, leaving two sides clear blanks, which were afterwards pasted together. However, this mode of printing soon gave way to a superior species of execution, by the *typi mobiles*, first formed of wood: those, in their turn, made way for cut metallic types, which were succeeded by those fusil metallic types now in use.

In the early stages of printing, they frequently omitted the capital and initial letters, leaving them blank for illumination in gold or azure. It has been said, this was designedly done for the purpose of imposing upon the public printed copies for MS. transcripts. The report which is in circulation concerning *Faust*, appears to come in support of this assertion; it being said he was at *Paris*, and offering a quantity of his bibles for sale as MS. The French, considering the number of them, and also remarking the exact similarity and accuracy of the copies even to a single point, concluded it was impossible for the most accurate copyist to have transcribed them so correct. They suspected him of necromancy, and either actually indicted him, or threatened to do so, for conjuration; and by this means extorted his secret. Whence came the origin of the popular story of *Dr. Faustus*; his dealing with the devil, and tragical death. From Mentz, in 1462, when it was plundered and disfranchised of its former liberties, printing spread through a great part of Europe, particularly its artizans in that branch of art, settled at Haerlem, Hamburgh, and other places; from Haerlem it travelled to Rome in 1466, when the Roman character was adopted in 1467, and soon perfected.

In the reign of Henry VI. Cardinal Thomas Bourchier, Archbishop of Canterbury, sent *R. Turnour*, Master of the Robes, and *W. Caxton*, merchant, to Haerlem, to learn the art. These persons privately prevailed upon *Corselis*, an under workman, to come to England; and a press was established at Oxford. This detail appears in a MS. chronicle, still preserved in the archiepiscopal library in Lambeth Palace; and is cited by Atkyns, in his *Origin and Growth of Printing in England*, published in London, 1664. This chronicle informs us, that the execution of this concern, entrusted to Turnour and Caxton, cost 1500 marks; that printing was established at Oxford, before there was any printer or printing-presses in France, Italy, Spain, or Germany, except the city of Mentz, which is said to claim seniority over even Haerlem itself, styling herself *Urbem magnatnam artis typographicæ inventarium primum*; though it is said there to be known to be otherwise, and reciting the facts previously stated.

There have been exceptions to certain parts of the previously stated details, but they appear to have insufficient force to supplant them, as satisfactorily established by Dr. Middleton, Mr. Bowyer, and other respectable authorities.

The University press being discovered to be too remote from the seat of government, and too great a distance from the sea, other presses were soon established at St. Alban's and the Abbey of Westminster.

Among the contending factions with respect to dates, persons, &c. Mr. Bowyer thinks he can discover from a passage in the Second Part of Shakspeare's *Henry VI.* that printing was introduced into this kingdom more early than has been generally believed. From, perhaps, as equally good authority, that passage of *Job* might be here adduced, to prove it existed in the days of *Moses*, admitting that legislator to have been its author, for our common translation expressly speaks of the art in ch. xix. v. 23; and, perhaps, the translators spoke of it for no better reason than did *Shakspeare*,—*because it existed in their day.* *Shakspeare*, with all his confessed merit, was frequently guilty of anachronisms, which, were this the place, could be easily pointed out in various instances.

In 1467, printing was established at *Tours*; at *Reuthlingen* and *Venice*, in 1469; and it is likely in the same period at *Paris*, where Gering, Crantz, and Friburger, all Germans, were invited by the doctors of the Sorbonne, who established a press in that learned house.

As yet there had been no printing but in the Latin and vulgar tongues; 1st, in, we conceive, German characters; 2d, Roman letters, it is suspected, succeeded these; 3d, in Gothic; and 4th, in Italic. But in 1480, or as has been said in 1476, the Italians cast a set of Greek types; and either at *Venice*, *Milan*, or *Florence*, the first *Greek* edition appeared. The Italians also, have the honour of having produced the first *Hebrew* types, printed at the same time with the Greek, at *Soncino*, a small city of *Milan*, under the direction of two Jewish rabbins, Joshua and Moses, in the year of the world 5244, and A.D. 1484.

Towards the end of the sixteenth century, various editions appeared in Syriac, Arabic, Persian, Armenian, Coptic, or Egyptian characters, chiefly for the gratification of the learned and curious, and in part for liturgic purposes, for the Christians of the Levant. Those were printed chiefly in Paris, whither M. *Savary*, then ambassador at the Porte, had sent punches and matrices.

From Europe, printing was carried to almost every part of Asia, Africa, and America.

In this country, the late very ingenious Earl Stanhope, among a great variety of other useful inventions, contributed greatly to the improvement of the printing-press, which he constructed wholly of iron. He was also the revivor in this country of the invention of stereotype printing, which he brought to great perfection.

Without actual observation, no conception can be formed of the facility with which an expert compositor will set up a type, and which will require but little correction. We regret our want of room compels us to resist describing the various processes and materials: but we should not be pardoned were we to omit, that among other purposes to which the power of steam is rendered subservient, that of operating upon machinery to perform the very laborious operation of the pressman, is among the latest efforts of mechanical ingenuity, whereby the facility of operation is so greatly improved, that, whereas formerly only 250 copies could be produced in an hour, now, by this improved mode, they can easily work of 800. Mr. Walters, proprietor of *The Times* newspaper, had the first machine erected, at an expense of about £3000; indeed, it is in the case of such rapid execution as newspapers require, where expedition is a chief consideration, that such expensive machinery can be likely to become general.

LITHOGRAPHY.

LITHOGRAPHY is the art of chymical printing, which claims for its author ALOES or ALOYS SENELFELDER, a native of Munich, in the kingdom of Bavaria. The history of this useful art is recorded by the only person capable of assigning proper and correct motives, and of tracing the various means which were employed to arrive at the desired end, to ultimate success: had all other useful inventions, profitable and elegant arts, had the good fortune which this has happily experienced, we should not have had so much cause to regret deficiencies as we have frequently experienced in the course of these our inquiries; then would the various illustrious authors of arts have had justice rendered them; and still have remained possessed of that glorious immortality so justly the reward of transcendant merit. For the history of this meritorious invention is given by the original author himself. Thereby securing to it those advantages, which the elegant author of the preface congratulates the public upon; when in his concise epistle he uses that beautiful expression of his

own countryman Klopstock, where he says, “ Covered with eternal darkness are the great names of inventors.”

This work has been recently translated into our tongue, and published with the following title. “ *A complete Course of Lithography, containing clear and explicit Instructions in all the different branches and manners of that Art; accompanied by illustrative Specimens of Drawings: to which is prefixed, a History of Lithography, from its Origin to the present Time: by ALOYS SENELFELDER, Inventor of the Art of Lithography, or Chymical Printing: with a Preface by FREDERIC VON SCHLICHTHEGROLL, Director of the Royal Academy of Sciences at Munich.—Translated from the original German, by A. S.*”

The author of the preface, and friend of the inventor, states that it is an art, whereby the artist, a minister, a man of letters, or a merchant, &c. may multiply his productions at will without the intervention of a second person.

After a neat and brief historical preface by Mr. Schlichthegroll, the author of the invention and of the work proceeds to give in detail his motives for the original invention;—in which he has not only been strictly circumstantial, but no more so than the curiosity of the public requires, which is always excited in a degree proportionate to the confessed utility of a work, or that demand which its elegance has upon cultivated and delicate feeling. His labours may be said to be divided naturally into two parts, of which division the author has availed himself; 1st, adducing its history; and, 2dly, affording the operation of its process.

Its history appears to have arisen with its origin; and both to have taken their data from the often recognised motive furnished us by Diodorus Siculus,—and to have originated in the *necessities* of the author. From whence, it appears, that after he had received a scholastic education to qualify him for the profession of the jurisprudence of his country, the death of his father, who was a votary of the Thespian art, deprived him, his son, of those resources essential to enable him to pursue his intended honourable avocation; he was, consequently, driven to seek support from the previous acquisitions of his mind. He accordingly devoted his earnest attention to solicit the favours of the dramatic muse as an author: after encountering numberless difficulties he produced one play, which was printed, and its sale succeeded tolerably well. But the honourable independence of his mind induced him to reflect upon the *certainty* of the large expense which necessarily attends the practice of an author, who has not liberal patrons in the public, or the

trade; and the uncertainty of adequate remuneration from the public, for whose benefit they make such large sacrifices of time, ease, property, and often health. These reflections induced his ardent and ingenious mind to endeavour to avoid the uncertainty of this contingency:—he did not possess property to enable him to establish himself as a printer; he was consequently compelled to have recourse to the ingenious resources of his own mind:—he tried various, and, at first, several unsuccessful experiments, which he ingeniously details; because nearly as much is learnt from the failures of an artist, had he always the honesty to proclaim them, as is gained from his most successful discoveries.

Various were the materials upon which he first essayed to complete his purposes; till, at length, chance directed him to try what could be effected upon stone; for this purpose, he used a species raised in Germany, of a beautifully close grained and dense kind, susceptible of receiving a fine polish, called *Kellheim* stone: knowing the failures which his countrymen had experienced in endeavouring to fix the ink in this stone for etching, he had recourse to a chymical expedient to obviate this, which succeeded in the following manner. To four or five parts of water, he added one of rectified oil of vitriol, which instantly produced an effervescence, on being poured upon it; the stone was presently covered with a coat of gypsum, which to vitriol is impenetrable; this is easily wiped off, and the stone being dried, it is fit for use. The next expedient which he found necessary to resort to, was the discovery of a species of ink, proper to answer the peculiar purposes of the material whereon he had to operate. For which he discovered none so well adapted as the following mixture: “A composition of three
“ parts of wax with one of common soap, is melted over a
“ fire, and mixed with a small portion of lamp-black dis-
“ solved in rain water.”

We beg to observe, that we have understood Bath and Portland stone is sometimes properly prepared; but the best stone yet found in Britain, for that purpose, is what is known by the name of *lias*, raised near Stratford-on-Avon, in Warwickshire; it is a calcareous, and partly siliceous stone, and we think not destitute of magnesia, having, when polished, a very silky and somewhat saponaceous feel.

That common sense of justice, which is due from every man to his fellow man, withholds us from giving farther details of M. Senelfelder's ingenious publication. If not so minutely abstracted as might have been, we think we can answer for the correctness of what is given.

MISCELLANEOUS.

BURNING, OR HUMAN VOLCANO.

THERE are circumstances related, which, were we not certain that the authority was good from whence they are reported,¹ would not have our attention,—which have reference to an ignition discovered sometimes to take place in the human frame, producing its entire destruction. It is first to be observed, that those subjects where this has occurred, are generally fat, chiefly women, and in years, also in the habit of frequent indulgence in inebriety, generally excessive drinkers of spirits; likewise that it has generally happened when the party was in an intoxicated state.

Of the intensity of this fire we may form some idea, because the fiercest funereal fires always left relics of bones or some small portion of the body unconsumed; whereas, this fire reduces the bones and every part of the body into an impalpable powder, in a state of humidity.

A philosopher of Verona has maintained, we understand, in a series of sound argument and clear ratiocination, that a conflagration may arise from the inflammable nature of materials found existing in the human frame, without the aid of any exterior cause. Some maintain, and among them Signor Branchini, that in one instance which we shall recount, it arose, as well from internal fire, as from some camphorated spirit of wine, which the lady had been previously using.

There was a spontaneous combustion took place in the case of a woman of Paris, who was in the habit of drinking brandy to excess, and who was one night reduced to ashes from the before mentioned cause,—all but her head and the ends of her fingers. *Novum Lumen Phosphor. accens. Amst. 1717.* The second was Signora Corn. Zangari, or as called Corn. Bandi, a lady aged 62, of unblemished life, near Cesena, in Romagna, who suffered the same fate. This is the case to which previous allusion is made, in the remark by Signor Branchini: she had retired to her chamber somewhat indisposed, and in the morning was found in the middle of the room, reduced to ashes, all except her face, skull,

¹ Phil. Transactions, No. 476, p. 453, *et seq.*

three fingers, and legs, which remained entire, with shoes and stockings on. The ashes were light, and on pressure between the fingers vanished, leaving a gross offensive moisture, with which the floor was smeared; the walls and furniture of the room covered with moist unctuous soot, which had also stained the linen in the chest, as well as penetrated into a closet; it had also ascended into an upper room, the walls of that also being moistened with the same viscous and highly offensive matter. *Mem. de Trev. an. 1731. p. 1293.*

The third we shall mention, occurred in this country. Grace Pet, of Ipswich, Suffolk, aged 60, in 1744, who had previously drank a large quantity of spirituous liquor: the trunk of her body was found incinerated, resembling a heap of coals, covered with white ashes, and emitting an extremely foetid odour and smoke.

The fourth case is that of Mary Clues, of Coventry, aged 52, in 1772, who was so much addicted to intoxication, that scarcely a day passed in which she did not drink, at least, a pint of rum, or aniseed water. In her case, nothing remained of the skin, the bones, and the viscera; the bones of the cranium, the breast, the spine, and the upper extremities were entirely consumed; a most disagreeable vapour had exuded from the apartment where the combustion occurred.

The fifth is a similar instance, mentioned by *Vief d' Azyr*, in the *Encyclop. Methodique*; a woman, about the same age as the last, indulged in excessive spirituous liquors, went to bed every night intoxicated,—was found reduced to ashes.

Le Cat, in a memoir on spontaneous burning, mentions many other instances of combustion of the human body. Two facts of a similar kind are stated in the *Journal de Medicine*, vol. lix. p. 440.

Among other instances, besides the preceding, there is one recorded by Dr. *Swediaur*, of some persons at Warsaw, who had drank abundantly of malt spirits, and fell down in the street with smoke issuing from their mouths: the people who came to their assistance said they would take fire; to prevent which, they poured down their throats large quantities of milk; and, it is presumed to get the offensive matter from the stomach, drenched them with a considerable portion of fresh made human urine. Which cases are likewise mentioned by M. le Lair, in his memoir to the Philosophic Society at Paris; from whence that author reduces circumstances of this description to the following heads: 1st. The persons who have been the victims were generally much addicted to vicious excess in drinking of

strong spirituous liquors ; to which intemperance the inhabitants of the north are most subject, and consequently to these accidents. 2d. They are usually very fat. 3d. The combustion has happened more frequently in the case of women. 4th. These women were old. 5th. In one case their bodies did not appear to have been burnt by a combustion perfectly spontaneous ; but perhaps in consequence of some very slight exterior cause, as a lighted taper, candle, or tobacco-pipe. 6th. The extremities of their bodies, as the legs, hands, cranium, &c. escaped the fire. 7th. Water, as in the burning of oil, or greasy substances, would increase, it is conceived, instead of allaying the flame. 8th. The fire very slightly damaged, and in some instances did not injure other combustible objects with which it came in contact at the moment the body was consuming. 9th. The combustion of these bodies left a residuum of oily and foetid ashes, with greasy soot of a most disagreeable smell.²

After the enumeration of these circumstances, the author advances a variety of hypotheses to endeavour to ascertain the cause, but without effect ; the facts not being sufficiently numerous to give aid to his purpose.³

We are inclined to embrace the hypothesis advanced in the previously cited *Journal de Medicine* ; which is, that these destroying internal fires are first produced in the stomach and intestines of the body by inflamed effluvia, or juices, and fermentations in the stomach ; perhaps aided by that phosphoric or carbonaceous gas, arising from strong fermentation of spirits, &c. formed in the region of the stomach, of a similar nature with that discovered in empty vessels which had contained strong spirits, or in mines, which sometimes takes fire on contact with the igneous element ; and from the phosphoric and camphoric nature of numerous juices which abound in the human body, particularly in fat subjects. The fiery evaporations which exhale from the settling of spirits in the *tunica villosa* of the stomach, and other adipose fat membranes without, which those spirits ingender fumes of a camphorated quality, which in sleep are augmented by full respiration, and are put in a stronger motion and more apt to take fire.

The insulated and in part concealed facts which have attended all those instances, except the one at Warsaw, will not afford a sufficiency of evidence to arrive at the exact cause, to enable us to ascribe it to any definite circumstance, except those general ones previously enumerated. *Therefore the most we can do is to caution, with*

² Phil. Trans. No. 476, p. 453, *et seq.*

³ Ibid.

emphasis, all people, particularly the fat, short-necked, and the aged, from the indulgence of that habit, which has been in every instance, except one, the Italian one, the certain precursor to this lamentable catastrophe;—refrain from inebriety, and the use of ardent spirits in particular, when, it seems, the effect may be avoided.

BURNING MIRRORS, OR SPECULA.

Burning Mirrors, or Specula, are of two kinds; but each, or either, collecting the rays of the sun into one concentrated point; by which means a force of heat is produced, that exceeds every other ignitious power known in nature, or which can be raised by art. The first description are convex, called *lentes causticæ*, which transmit the rays, and in their passage incline them by refraction to an axis, having the property of lens, and acting according to the laws of refraction. The second, and most usual, are concave, and though, perhaps improperly, called burning glasses, are usually made of metal; these reflect the rays of light, and in reflection incline them to a point in their axis, possessing the property of *specula*, or mirrors; and acting likewise by the laws which regulate reflection. That both kinds were known to the ancients, to a certain and limited degree, we think there can be no doubt; judging from various expressions: although we know it has been often alleged that they were only acquainted with the concave species, or that species operating by *reflection*. We accordingly find that both *Seneca* and *Pliny* take notice of the burning power of *specula*.

In a treatise on optics, usually bearing the scientific name of *Euclid*, their principle is recognised. See Theorem xxxi.

The theogonists of antiquity are thought to have lighted the sacred fire by their means. It is very evident, that if it ever was by accident extinguished, they never renewed it by the aid of vulgar fire; because a circumstance is mentioned of a party who once went from *Athens* to *Delphos*, on foot, and back in one day, to fetch some sacred fire; but who expired on his return the moment he set his foot in the temple. The circumstance of his monument is, if our memory serves us, mentioned by *Pausanias*, in his description of Athens and its statuary. But *Porta*, with some others, suppose, that the burning mirrors of the ancients were made of metal, in the form of a section of a parabola, with the vertex cut off; it being the well-known property of this curve to reflect all rays which fall upon it, parallel to its

axis into the focus. We are informed by historians, that *Archimedes*, by means of reflecting mirrors of this, or some other description, burned the Roman fleet, under the command of *Marcellus*, lying before, and laying siege to *Syracuse*. The machines then used for those purposes, no body questions, were concave, and had their power by reflection; it being pretty evident that the ancients were unacquainted with the refracted focii of convex glasses. Yet, it has been observed by *M. de la Hire*, that in the *Clouds* of *Aristophanes*, Strepsiades tells Socrates of an expedient he had to pay his debts, by means of a round transparent stone or glass, used in lighting of fires; by means of which he intended to melt his bond, which in those days were written on wax. The glass here used to light the fire and melt the wax, *M. de la Hire* observes, could not be concave, as a reflected focus coming from below, inwards, would have been improper for the purpose. The old scholiast upon *Aristophanes* confirms the same sentiment. *Pliny* mentions globes of glass and crystal, which being exposed to the sun, burnt the clothes and flesh upon people's backs; and *Lachinilius* adds, that a glass sphere full of water, and held in the sun, lighted the fire even in the coldest weather; which, besides proving the effect of convex glasses, also informs us the ancients knew their use, at least as far as simple reflection was concerned.

That they must also have been acquainted with the magnifying power of glasses, contrary to the generally received opinion, is evident, from considering the delicacy and minuteness of some of their works; upon this point we are satisfied, from what appears in a former part of our labours; because we know the works alluded to could not have been performed without optical aid. Those who so strenuously deny this knowledge to the ancients, should reflect upon the length of time which elapsed between the discovery of spectacles and telescopes, being upwards of 300 years, and then they would not have so partial a feeling for the excellencies of their own day, as to affirm that sciences, arts, and knowledge, were concealed from the wise of antiquity, and are only revealed to themselves and their sagacious and sapient contemporaries.

The fact will appear upon examination to be thus: the principles of general science and universal art were better understood by the learned of antiquity than they are among those of the moderns; the latter, perhaps, possess some slight advantage over the former in this, that their workmen aided by subsequent inventions, have the means to execute the directions of the scientific with more accuracy, conse-

quently with more certainty and truth, than had the ancients. We only know of one chief science where the moderns can boast a decided superiority over antiquity, which is in the light afforded by modern chymistry the better to comprehend the component properties of nature. But this we derived from a silly circumstance, from the voyage in quest of the *philosopher's stone*. Let it not be told that our most boasted superiority in wisdom, was generated by the extreme of our folly.

Every concave mirror, or *speculum*, collects the rays dispersed through its whole concavity, subsequent to reflection, into a point or focus; and by this means it becomes a burning mirror.

As the focus is found where the rays are all concentrated in a certain point, should it be the segment of a large sphere, its breadth must subtend an arch above 18 degrees; should it be a segment of a smaller, its breadth may be 30 degrees; this is verified by experiment. The surface of a mirror which is the segment of a larger sphere receiving more rays than that of a less; if this intuitive truth be admitted, it follows, that if the arch subtend 18 degrees, or more, should it be equal, the effects of the greater mirror will be more potent than those of the less. And as the focus is contained between the fourth and fifth parts of the diameter, mirrors that are segments of a greater sphere, burn at a greater distance than those which are segments of a smaller.

Since the last consideration is that the burning must depend upon the union of the rays on the concave spherical figure, it will not be surprising, that wooden mirrors gilt, or those prepared of alabaster, &c. covered with gold, nay, even if they be made of paper and covered with straw, should be found to produce ignition.

Among the ancients, the burning mirrors of Archimedes and Rocques, are eminent; by those of the first, the Roman fleet besieging Syracuse, under the command of Marcellus, as related by Zonaras, Tzetzes, Galen, Eustathius, Anthemius, &c.; and by the other, the navy of Vatalian besieging Byzantium, according to the same Zonaras, were burnt to ashes.

The fact of the surprising effect of the burning mirrors of Archimedes has been doubted by many of the scientific world among the moderns, and by none more than *Descartes*, who positively discredited it, and principally from his conviction of the utter impossibility of constructing concave mirrors of a sufficient focal distance for the purpose. If the scepticism of *Descartes* carried him so far,

subsequent experiments have been made by which it is found that *specula*, ingeniously constructed, may effect ignition at as great a distance as it was probable the ships of the hostile visitants might lie from the shore. And with a view to vindicate the ancient historians previously named, none felt more zealous than did the eminent and learned *Kircher*, who went with his pupil *Schottus*, to the scene of the historical transaction, where *Kircher* made many experiments in order to validate the credibility of his historical predecessors. Conceiving the concave *specula* of the ancients were sections of a parabola, he began with combining several of this figure; but failing of success, he next tried the effect of a number of plane mirrors; and with only five mirrors of the same size, placed in a frame, he contrived to throw the rays reflected from them to the distance of more than 100 feet; and by these means he produced such a degree of heat, as led him to conclude that by increasing their number, he could set fire to any inflammable substance at a greater distance.

The ideas of the master and his pupil both concurred, on examining the local spot, that it was probable the galleys of *Marcellus* could not be much more than thirty paces from the machinery of *Archimedes*. This they presumed, in total ignorance of the exquisite perfection to which it is probable that able mathematician had brought his invention. *M. Buffon*, though totally ignorant of those historical testimonies relative to the effect of the invention of *Archimedes*, and also ignorant of the attempt of *Kircher* in its vindication, has long since, by a similar contrivance, sufficiently evinced the practicability of the operation.

Dr. Wolfe, in the year 1768, after describing some parabolic mirrors of *M. Hoesen*, of *Dresden*, offers a conjecture that those of *Archimedes* might be of this kind; since it is not difficult to describe a parabola whose parameter is 2000 feet; and that rays reflected from such a speculum might be received by a lens, and having been brought to a focus, transmitted parallel to any distance. But it appears that he was not aware of the experiment which *Kepler* and *Dechaler* had made, showing, that no rays could be conveyed parallel to one another, except those which proceed from the same point in the sun's disk. *Datens du Miroir Ardent d'Archimédie. Paris, 1755. Phil. Trans. vol. xlviii. p. 621, &c. et Ibid. vol. lix. p. 8.*

Those mirrors, the most remarkable which the moderns have constructed, shall now be mentioned. That of *Maginè*, twenty inches in diameter; of *Septala*, of *Milan*, near three

feet and a half in diameter, which burnt at a distance of fifteen or sixteen paces; of Villette and Tschirnhausen; the now complete one of Buffon; that of Trudaine, and also that of Mr. Parker. M. Villette, a French artist, at Lyons, constructed a large mirror, bought by Tavernier, and presented to the King of Persia; another was bought by the King of Denmark; a third by the French king, and presented to the Academy Royal; and a fourth was publicly exhibited in England. Dr. Desagliers and Dr. Harris found that this last produced the following effects on the substances subsequently mentioned:

A silver sixpence in 7" melted.

A halfpenny of George I. in 16" melted, and running with a hole in 34".

Tin in 3" melted.

Cast iron in 16" melted.

Slate in 3" fused.

A fossil shell in 7" calcined.

A piece of the *black* part of Pompey's pillar, from Alexandria, *granite*, in 50" vitrified.

The *white* part of ditto in 54" vitrified.

Copper ore in 8" melted.

Bone in 4" calcined.

The same substance in 35" vitrified.

An emerald melts into a substance like Turquoise stone by its power.

A diamond, whose weight was eight grains, lost seven-eighths of its weight.

Asbestos vitrified, as all other bodies did, if kept long enough in its focus; but when once vitrified, heat has no farther power.

This mirror was 47 inches wide, and ground to a sphere of 76 inches radius; in substance a composition of tin, copper, and tin glass.—*Phil. Trans.* v. iv. p. 198.

Tschirnhausen's mirror comes next. These things are noticed of it in *Acta Eruditorum* for 1687, p. 52.

Green wood takes fire instantaneously, which ignition is not destroyed by strong wind; water boils immediately; eggs boiled in it are perfectly edible; a mixture of tin and lead, three inches thick, dropped presently; iron or steel plates presently became red hot, and soon burnt into holes; things incapable of melting soon became red hot like iron; slate first became white, then black glass; tiles converted into yellow glass; shells into a black yellow glass. A pumice-stone emitted from a volcano melted into white glass; a piece of a crucible vitrified in eight minutes;

bones changed into opaque glass, and earth into a black one. It was made of copper of about $\frac{1}{8}$ of an inch thick, $4\frac{1}{2}$ French feet diameter; it burnt at a distance of 12 feet, performing the above operations.

It should be observed, that every lens, whether convex, plano-convex, or double-convex, collects the sun's rays dispersed over its convexity, into a point by refraction, which constitutes a burning-glass. The most considerable of these known are what have been previously mentioned, and the following one made by M. de Tschirnhausen: the diameters of his lenses were three and four feet; their focus happened at a distance of twelve feet; its diameter one inch and a half: to make the focus more vivid, the rays being collected a second time by a second lens, parallel to the first, and situated in that place where the diameter of the cone of rays, formed by the first lens, is equal to the diameter of the second, so that it received them all, and the focus from an inch and a half was contracted into a space of eight lines, and its force increased proportionally. It was purchased by the Duke of Orleans, who presented it to the French Academy. Weight 160 lbs.

Its effects are partly enumerated as follows: it lights hard wood, moistened with water, instantly; boils water directly; melts all metals; brick, stone, earthen-ware, and asbestos, are transmuted into glass; sulphur, pitch, and other inflammable substances, set on fire beneath water; ashes of vegetables, woods, and other matters, transmuted into glass: in brief, every thing applied to its focus was either melted, turned into calx, or smoke. The colour of jewels, and all other matters, except metals, were changed. Succeeding best when the matter applied is laid on hard well burnt charcoal.

Sir Isaac Newton's burning mirror, consisted of seven concave glasses, each $11\frac{1}{2}$ inches in diameter, so disposed as to have one common focus; six of them were placed round the seventh contiguous to it, so as to form the segment of a large sphere, whose subtense was about $34\frac{1}{2}$ inches, the focus $22\frac{1}{2}$ inches distant, and its diameter about one inch. This speculum vitrified brick or tile in one second; in 30" melted gold; which instrument has been since improved by M. Zeicher, by forming panes of plain glass to a necessary degree of curvature, by heating them so hot on a dish made of metal that they all readily assumed the same form. The most considerable improvement was made by M. Buffon, by constructing his machine of such a number of mirrors, by which he appeared to have aspired

to the grand secret of Archimedes, and to have vindicated historical credit, by showing what was possible; for in anno 1747, he constructed a machine with 140 plane mirrors, each about four inches long, and three broad; these fixed at a quarter of an inch distant from each other, upon a wooden frame of six feet square. Each of them had three moveable screws, so contrived that the mirror might be inclined to any angle, and meet the sun in every direction; by which means, the solar image in each mirror was made to coincide with all the rest. The first experiment was tried with only 24 mirrors, which readily ignited combustible materials, consisting of pitch, tow, &c. at a distance of 66 French feet.

He then put together a kind of polyhedron 168 pieces of plain looking-glass, each six inches square, by which some boards of beech-wood were inflamed at 160 feet distance, in the month of March, and a silver plate was melted at 60 feet distance. This machine, besides its other advantages, might be moved to burn upwards, downwards, or horizontally, burning in a near or distant focus, which common burning-glass will not do, from their focus being fixed and determined. In its next stage of improvement, it had 360 plane mirrors, each eight inches long and six broad, mounted on a frame eight feet high, seven broad, which vastly improved its power of combustion; but when the whole machine in its most perfect state was employed, it produced the following wonderful effects: wood was kindled in a clear sky at 210 feet. The focus at 50 feet, about 7 inches broad; at 240 feet, it was 2 inches in diameter. M. Buffon afterwards constructed a machine, which contained 400 mirrors, each half a foot square, with which he could melt lead and tin, at a distance of 140 feet.—*Phil. Transactions Abridged*, x. 194, et *M. de Buffon Histoire Naturelle, &c. Sup. to Montuda Hist. des Mathematiques*, i. 232.

We have now to present a memoir of a burning-glass fabricated in this kingdom, said to have been the most powerful one yet constructed. It was made by Mr. Parker, of Fleet-street, London, and cost upwards of £700; it would, however, serve to fuse and vitrify such substances which would resist all common and chymical fires, how intense soever, and more especially was found capable of applying heat in *vacuo*. It consisted of a lens of flint-glass 3 feet in diameter, which, when fixed in its frame, exposed a surface of about $8\frac{1}{2}$ inches in the clear; it was without defect, except a disfigurement in one of the edges, by a piece of the scoria of the mould, which had procured access into the

substance. It was double-convex, both of its sides were a portion of a sphere of 18 feet radius. The largest lens, whose diameter in the frame was 3 feet, in the clear 2 feet 8½ inches; its thickness at the centre, 3¼ inches; its focal distance 6 feet 8 inches. Diameter of the burning focus at that distance 1 inch; weight 212 lbs. It had a second lens, whose diameter in the frame was 16 inches, showing in the clear 13 inches; thickness in the centre 1⅝ of an inch; its weight 21 lbs. When both lenses were compounded, the length of the focus was 5 feet 3 inches; its diameter half an inch. Both these lenses were fixed in a truncated cone, formed of twelve ribs of wood: at the larger end was fixed the great lens, and in the small extremity the lesser lens, where is also fixed a rack passing through a pillar, moveable by a pinion turning in the said pillar, by means of a handle; and thus giving a vertical motion to the machine. A bar also of wood was fixed between the two lower ribs of the machine, which moved an apparatus with an iron plate fixed to it, which, at this part, turned on a socket, thereby affording a method of placing the matter under experiment, so as that it may be acted upon by the focal rays in the most direct and potent manner. It is placed in a strong mahogany frame, moving on castors; immediately under the table of it are three friction wheels, by which the machine is moved horizontally. There is also a strong iron bow, on which the lens and cone hang. If it be difficult to furnish an idea of this piece of ingenious mechanism without plates, it becomes much more so to give positive testimony as to its effects. Because, it should appear, that circumstances attended that instrument, which distance human calculation; as it cannot be ascertained what should be deducted for the loss of power in consequence of the impediments in the glass of which it was made, as well as from the *four* reflections, that is, a double reflection on immersion, and two more on emersion of the rays of heat, but by way of diminution;—a data has been fixed to appreciate it, by making a full allowance for those deductions which must be considered as the result of a concentration of the power of the solar rays, after deducting ample allowance for subtraction, in consequence of the previously surmised obstructions, analogous to those usually allowed for the friction of an engine, of which nature they have been conceived to partake.

The solar rays received on a circular surface of 2 feet 8½ inches, when concentrated within the diameter of one inch, will be 1056.25 times its intensity, or this number of times greater than the heat of the sun, as falling on the

surface of the earth. Supposing the heat of the *air* in ordinary weather to be 65° , in sultry weather 75° , giving an average medium of 70° , even without allowing for the most potent operation of a mid-day sun. Taking the degree 70 as the average effect, the calculation will appear as follows: the accumulated power of this lens, presuming the effect to be equal over the entire surface, the concentrated heat at the focus would be equal to $73,938^{\circ}$.

Those who had an opportunity to examine the effect of this lens, will remember, that the external part of the focal effect was less intense than near the centre; but it being conceived possible that the refraction of the light and the effect of the caloric fluid, may not take place at the same angles. It has, therefore, been thought by the ingenious author of those calculations,¹ from whence this memoir is extracted, to deduct one-fourth thereof as a compensation; after which there remains $55,454^{\circ}$, as the expression of its power.

And as the application of the second lens reduced its focal diameter to half an inch, the effect, without allowance for the reduction of its power, would be equal to $221,816^{\circ}$, deducting one-fourth for a second transmission, there remains $166,362^{\circ}$, as the expression of its power.

Admitting the solar rays emanated from a point, the focus of the lens would be also a point; for the rays transmitted through one edge of the lens would meet those transmitted through the other edge, so that the focus would be without parts, or a mere mathematical point: but as the sun is known to measure $31' 32''$ during his apogee, and $32' 28''$ during his perigee, the focus must necessarily be 0.7105 parts of an inch at Midsummer, and 0.7594 at Christmas. The length of the luminous axis at Midsummer, must, from the same cause, be 3.428 inches, and at the opposite period 3.557; because the dimensions of the focus are actually dependent on the apparent diameter of the sun, its semi-diameter being to be added to increase the measure of the converging rays on the opposite sides, the tangent of which is the semi-diameter of the focus; and by the same means the length of the axis is discovered, adding to and subtracting from the converging angle, by which means the points at which they meet on the axis are discovered. Those two points disclose the commencement of the luminous appearances thereon.

The variation between the above calculated diameter of

¹ Dr. Rees.

the focus, and what it really was, of necessity points out the errors in the instrument, which must arise from one of two causes, or, perhaps, from both; *i. e.* that the axis of the two sides are not coincident,—or that they are *not* opposite to each other; should the difference be occasioned by either, the focus would have been elliptical; but this not being ascertained, it can be only said that a very small deviation in each would have occasioned this enlargement of the focus; and it is possible they might have acted in contrary ways, which would have made it nearly circular.

As this ingenious lens was exported many years ago, before it was ascertained to what cause the above mentioned variation was ascribable, *i. e.* whether the focus stated to have been one inch in diameter, was really ascertained by its burning effect, or by the diameter of the focal rays, the enlargement whereof must have arisen from the previously mentioned causes; but if it could be ascertained from its burning power, it assuredly tends to confirm Dr. *Herschel's* opinion, that the rays of caloric are less refrangible than rays of light, and which, by-the-bye, also confirms a previous opinion on the doctrine of light, we have presumed to hazard. And then the true burning focus will be discovered to be rather beyond the apparent focus. The ingenious experiments of Mr. Wedgwood, and the extensive use his *Pyrometer* has obtained, for the admeasurement of heat required to melt metals, are now so well established, and too well understood to render eulogium necessary; it may be sufficient to state his estimates of the heat required to melt the following substances.

	Fahrenheit.	Wedgwood.
Red heat, visible in day-light.....	1077°	0°
Fine gold	5237	32
Welding heat of iron, greatest	13,427	95
Cast iron melts.....	17,977	130
Greatest heat of his small furnace..	21,877	160
Extremity of scale of pyrometer ..	32,277	240

The power of the lens, estimated by this pyrometer, will be found to be 1096°; and presuming the hottest furnace to be 240, the focal heat thereof is 5.2975 times greater.

The learned and ingenious author, from whom these extracts are taken, then, in justification of his previously cited opinion, proposed to submit a selected enumeration of experiments made with that celebrated instrument, under the inspection of several scientific persons, and also members of the Royal Society, and others.

Different Substances fused.	Weight in Grains.	Time of Fusion, Seconds.
Gold, pure	20	4
Silver, ditto	20	3
Copper, ditto	33	20
Platina, ditto	10	3
Nickel	16	3
Bar iron, a cube	10	12
Cast iron, a cube	10	3
Steel, a cube	10	12
Scoria of wrought iron	12	2
Kearsh	10	3
Cauk, or terra ponderosa	10	7
A Topaz, or chrysolite	3	45
An Oriental emerald	2	25
Crystal pebble	7	6
Topaz	10	30
Flint, Oriental	10	30
Rough cornelian	10	75
Jasper	10	25
Onyx	10	20
Garnet	10	17
Zeolite	10	23
White rhomboidal spar	10	60
Rotten stone	10	80
Common slate	10	2
Asbestos	10	10
Common lime-stone	10	35
Pumice-stone	10	24
Lava	10	24
Volcanic clay	10	60
Cornish moor-stone	10	60

Mr. Parker also gave information, that a diamond, weighing 10 grains, exposed to this lens for 30 minutes, was reduced to 6 grains; during which operation it opened and foliated like the leaves of a flower, emitting white fumes, and when closed again, it bore a polish and retained its form. Mr. Parker, jun. also furnished the following observations upon the uncommon power of this lens. Gold remained in its metallic state without apparent diminution, notwithstanding an exposure at intervals of many hours, but the rest, or eassel, which was composed of bone-ash, was tintured with a beautiful pink colour.

Platina.—The experiments evince that the specimens were in different states of approach to a metallic form; several of them threw off sparks, which in most instances were metallic.

Copper, after three minutes exposure, was found to have lost in weight. Iron, shear-steel. What is remarkable in this experiment is, the lower part in contact with the charcoal, was first melted, while that part which was exposed to the focus remained unfused; an evidence of the effect of flux in this metal; and likewise, perhaps, also in support of a previous suggestion, that the melting point, or where the greatest heat is found, is beyond the surface of the focus.

In iron scoria, and turnings of iron, the scoria first was operated upon, and before the turnings, contrary to expectation. Calx of iron, from vitriolic acid, precipitated by a mild alkali before exposure, weighed $5\frac{1}{4}$ grains, increased in weight a quarter of a grain, indicating that the increase was occasioned by the absorption of caloric.

Experiments were also made on regulus of zinc, cobalt, bismuth, antimony, and a variety of other substances, with a great variety of effects; but all tending to establish some useful knowledge with respect to the nature of those substances, and the power of intense solar fire upon them. The result of the experiment on 33 grains of fine kearsch, taken from the cannon foundry, was, that it evaporated very fast during 120", when there remained only 11 grains; after an exposure of 150", the residuum began to flow into small globules, which, when cold, were attracted by the *magnet*: this is said to be a proof in support of the vast superiority of this lens over the heat of any furnace yet known.

From what has appeared, it is hoped, that the immense importance of this instrument, when well constructed, in all cases where intense heat is required, beyond any other means of obtaining it, will be sufficiently apparent. With a view to assist the arts, we have been thus circumstantial.

MARINE FIRE.

MARINE FIRE, called also *Greek Fire*, (in French, *Feu Grégeois*,) because first used by the Greeks, about the year 660, under Constantine Pagonatus, against the Saracens, under Cizicus, in the Hellespont, with such effect that they burnt the whole Saracen fleet, in which were 30,000 men.

Concerning the true nature of this fire, the moderns are altogether unacquainted; the inventors keeping the mode of its preparation an impenetrable secret. Thus this, and numerous curious arts, have been lost to posterity: the only

individual who knew how to render glass malleable, Tiberius ordered to be put to death. *Plin.* xxxvi. 36. *Petron. Arbit.* 51. *Isidor.* xiv. 15. *Dio.* lvii. 21.

ALUM.

Term defined.—Called by the Latins *alumen*; by the Greeks it was termed *στυπτηρία*, from its styptic or astringent qualities. It is an *astringent neutral salt*, usually found in *calx* of one of three minerals, *iron*, *copper*, or *zinc*; or it is found in an earth of a peculiar white colour, and from its commixture with this vitriolic salt, called *alum-earth*. The preceding description of alum refers only to that obtained by chymical process. The ancients, it is presumed, knew not of the manufacture of alum, because some islands in the Grecian and Tuscan seas produced *natural alum*, called also *rock alum*, in great abundance; in the islands of *Melos*, *Lipara* and *Strongyle*, now called *Milo*, *Lipari*, and *Stromboli*. We understand it was also an article of Egyptian produce, for in the period of AMASIS, King of Egypt, the temple of the *Delphian* Apollo having been destroyed by fire, the people of *Delphi* procured subscriptions from various princes for the purpose of reinstating it; among others who subscribed liberally to repair this loss, the above-named Egyptian prince sent them one thousand talents of alum.

It is of a nature so nearly allied to vitriol, that the calx containing it is generally found in the vicinity of vitriol works. Also alum with vitriol contains the vitriolic acid. The earliest mention discovered in the ancients of alum, or *vitriol*, (by which name, it is surmized by a recent writer, we should understand the substance we now call alum,) is found in the works of that eminent naturalist *Pliny*, where he says, blue vitriol was made in Spain by the process of boiling. *Scopoli* and *Sage*, we understand, deny the existence of alum in our day in a natural state. Notwithstanding *Linnæus* and *Morand*, in their journey through Scandinavia, discovered some crystals of this kind, described in pages 291 and 469 of that work. It is, however, alleged by the before-mentioned writer, that real alum crystals are formed very rarely on minerals which abound in a great degree with aluminous particles, and not till they have been exposed a sufficient time to the open air and to the rain; and even then, he observes, they are so small, and

so much scattered, that it requires an experienced and attentive observer to distinguish them.¹

This most useful drug, used as an article for dying, was first, it is conceived, introduced for this purpose in Asia, or, perhaps, Africa, whence it is traced to Egypt.

However useful alum might have been in dying and medicine among the ancients, its good qualities appear to have been forgotten in that universal revolution which convulsed the intellectual energies of the human race, upon the decline of the Roman empire: to describe this cause would be difficult; or, perhaps, it was owing to a variety of concurrent causes; but that such was the effect is manifest, as consideration and reflection inform us, that in that barbarous ignorance, which succeeded to the former light of science and art, not only the arts of utility and convenience were ingulphed, but those of taste and elegance swallowed up together.

There are certain alum-works existing in the neighbourhood of *Constantinople*, named *Cypsilla*, or *Chypsilar*, according to Bellon:² the alum made at those works is called *alumen Lelbium*, or *di Metelin*. It is presumed the article procured now from Constantinople comes from that place. But so favourable was that neighbourhood for its production, that at the period of the capture of that city by the Saracen army, in 1453, a factory was established there, for the reception of cloth from Italy, for the purpose of dyeing. Subsequent to this period, till the year 1469, the Italians, and, in brief, the entire western world, had no alum but what they procured from the Turks; but at or about the period last named, *John de Castro*, an Italian, and a son of the famous lawyer of the name of *Paul de Castro*, returned to Italy from his slavery in Turkey, (where he had served a manufacturer of that article,) and then enjoyed a place in the Apostolic Chamber, Pius II. then filling the Apostolic chair. This *De Castro* discovered, being a man of genius, learning, and observation, a plant³ growing at Tolfa, in the kingdom of Naples, like what he had been accustomed to see in the vicinity of the alum-works near Byzantium, whence he concluded it possible that below there might be a similar production; he made some experiments, and among others calcined a portion of the rock, &c. which yielded alum: on his return to Rome, he informed his Holiness of the circumstance, which we will give in the words recorded in the life of that pontiff. Addressing the

¹ Beckmann, vol. i. p. 289.

² Bellon's Observations, at the end of *Clusii Exotica*, cap. lxi. p. 64.

³ The *ilex aquifolium*, or holly.

Pontiff, he said,—“ I announce to you a victory over the Turk: he draws yearly from the Christians above three hundred thousand pieces of gold, paid to him for alum, with which we dye wool of various colours, because none is found here, except at the little island of *Ischia*, formerly called *Ænaria*, near *Puteoli*, and in the cave of *Vulcan*, at *Lipari*, which being formerly exhausted by the Romans is now almost destitute of the substance. I have, however, found seven hills so abundant in it, that they would be almost enough to supply seven worlds. If you will send for workmen, and cause furnaces to be constructed, and the stones to be calcined, you may furnish alum to Europe; and that gain which the Turk used to acquire by this article, being thrown into your hands, will be to him a double loss. Wood and water are both in plenty; and you have in the neighbourhood the port of *Civita Vecchia*, where vessels bound to the west may be loaded. You can now make war against the Turk; this mineral will supply you with the sinews of war, that is money, and, at the same time, deprive the Turk of them.”

The Pope and his cardinals, we are told, considered those words of *De Castro* as the ravings of a madman, or the mere dreams of astrologers. We are informed, that the first neglect of the proposition of *De Castro* did not dishearten him, but he caused representations to be made to the Pope by various modes: however, eventually, the Pontiff employed skilful people, who discovered that the spot to which *De Castro* alluded actually contained the mineral producing alum, and, it is said, of a superior quality to the Asiatic article.

Anciently there was much alum brought from a place called *Rocca*, *Roha*, or *Raha*, in Syria, whence this salt is said to have acquired the name of *roche allum*. There were also anciently very considerable alum-works on a mountain in Phocis, lying close to Ionia: as the mode of manufacturing alum at that place is mentioned in the sketch of its history, we subjoin it. The stones found at the top of this mountain are calcined in the fire, and then reduced to sand, by being thrown into water; the water with the sand then boiled with a little more water, the sand becomes liquified, then falls to the bottom in a cake, which is preserved; the remainder of the water boiled up again with fresh sand, a fresh cake is procured: the hard and earthy part of the sediment is thrown away as useless; but the cakes before mentioned contain the aluminous substance, which being again refined by boiling, is made fit for use.

Alum was also, in comparatively ancient times, procured in Sardinia, Macedonia, and Spain, in a natural state; since which time the local spots where it existed yield a saline substance called *alum salt*.

SAL AMMONIAC.

It appears, from a writer of confessed Greek and Latin erudition, that Pliny, Dioscorides, and others of the ancient naturalists and historians, were unacquainted with the article now known by the name of *sal ammoniac*; although, it seems, they also had a substance which they termed Ἰαλς ἀμμωνιακός, or *sal ammoniacus*, which Pliny alleges to have been a native rock-salt found in the Lybian deserts, near the temple of Jupiter Ammon; whence our author appears to infer, he thinks it derived its name, which opinion he appears to have drawn from a passage in Synesius, who was a native Egyptian, born in the fifth century in Cyrene, and was a bishop of Ptolemais, the capital of that district. In one of his letters, he describes the many productions of his native country, among others, he mentions *sal ammoniacus*; thus, τουτους Ἀμμανος καλουμεν τους αλας· πετρα δε αυτοις ψαφαρα και κρυπτει, ην οταν αφλες επιβεβλημενην ὡσπερ επελκίδα, ῥαστωνη πολλη και χερσι και σκαλισιν αρουν το βαθος: το δε αναχωννυμενον αλες εισιν, ιδιεν τε ηδεις, και γευσασθαι την αλλην ηδονεν. *Synesii Opera, ed. Petavii Leutetiae, 1612, fo. p. 284, ep. 147.* Both, according to appearance and taste, were of a good quality, fit for use; that it lay under a soft sort of stone, which covered it like a crust; that it could be easily extracted when the stone was removed.

We have also the united testimony of Herodotus, Strabo, Arrian, and others, which appears to prove that rock-salt was dug up in Ammonia, and thence transported as an article of merchandize.¹ The first mentions a hill of salt, and we are informed by the last, that native salt was brought to Egypt as presents to the king and others, from the neighbourhood of Ammon, by the priests of that place, in boxes made of palms, worked together. Many pieces were three inches in length; and because this substance was purer than bay-salt, and as clear as crystal, it was particularly employed in sacrifices. This salt is conceived to be that which, under the name of *sal ammoniacus*, was sent from Egypt to

¹ Herod. lib. iv. cap. 182, p. 316. edit. Wersel. Strabo, lib. i. p. 84. ed. Amstel. 1707. Arrian de Expedit. Alexandri. lib. iii. p. 161, ed. Blancardi, Amstel. 1668, 8vo.

the King of Persia, like the water of the Nile, as is related by Athenæus, from an historian long since lost.²

An author of repute, after noticing the preceding, and with whose work the foregoing is collated, says, “When after every thing they, the ancients, have said of it, is collected and impartially examined, no proof will be found that under that name they understood our *sal ammoniac*. On the contrary, one will be convinced that *sal ammoniacus* was nothing else than impure marine salt. So much for consistency. The scepticism of the learned, alas! makes them desert those natural endowments, which nature has liberally allowed to some individuals of them; to what extremes will they not run when they embrace a particular opinion, or are prejudiced against already settled notions.

It is observed by the same author, that although the ancients had names for numerous chymical agents which are now in use, it is probable they were not more ignorant in any thing than in those portions of mineral produce which are now, in the present improved state of our arts, thought most important: he says, “The art of lixiviating earths, “and causing saline solutions to crystalize, was then so “little known, that instead of *green vitriol*, vitriolic minerals, however impure, were employed in making ink, dye “liquors, and for other things;”³ places for boiling vitriol were not then established; therefore Pliny beheld with wonder a piece of blue vitriol, which, in his time, was made in Spain.

The *sal ammoniac* known to the ancients is conceived to have been only common ROCK salt, that being the purest saline substance with which they were acquainted; we find it was used to supply the place of common salt in their sacrifices; and it is known that what they used for religious purposes, they, upon certain occasions, also applied to domestic utility. It is conceived we are warranted in this conclusion, from many of their gods having been only heroes deified after death. And as they thought themselves justified in partaking of the remainder of the sacrifices, after the favourite portion of each deity had been offered, it is, we submit, equally probable, they did not believe this or that species of salt as peculiar or sanctified to any deity, so as to preclude themselves the advantage of participating of its benefits.

For these reasons, we conclude, it was a general, a gratifying, and a necessary article used in their food. It is

² Athen. lib. ii. cap. 29, p. 67.

³ Beckmann, vol. iv. p. 360.

conceived, from the known properties of the article now so named, that their *sal ammoniacus* could not have been what we have now under that appellation, the taste of ours being very nauseous and disagreeable.

The preceding consideration, contrasted with what we shall presently submit, leaves the matter to the common sense of every one, whether the article used by the ancients, and by them termed *sal ammoniacus*, could be the same which we now identify by the same term, as the *sal ammoniac* of the moderns.

The Egyptian priesthood, in their sacred solemnities, and also the native manufacturers, in their manufacturing avocations, consumed large quantities of salt. Insomuch so, that it is presumed they could not obtain a sufficiency for every purpose, from the natural produce of the earth. And we want not authorities, who assure us, that to supply their own wants, and likewise to satisfy those of the mercantile interests of their country, they had a mode of preparing an artificial salt, to which they gave the same appellation, that we have seen they applied to their natural produce.

The materials from which they compounded their artificial production, are said to have been produced at the Egyptian manufactory by the soot of burnt camel and cow dung, which is used for fuel in Egypt, marine salt, and human urine. This, Sicard says, is what it is manufactured from at Demayer, in the Delta of Lower Egypt, by the process of sublimation, by the same means which our philosophic Boyle⁴ had spoken of as remote as his day; and what was anticipated by the younger Geoffrey, *i. e.* that *sal ammoniac* was composed of the *muriatic* and *volatile alkalies*, appears to have been a fact.⁵ Indeed, in the year 1716, the Jesuit, Sicard, gave the first certain intelligence of the process observed at the manufactories at *Demayer* in the *Delta*, describing in what manner the salt was there produced by sublimation in glass vessels. Also, in 1719, the French Academy of Sciences at Paris, received from Le Mere, French Consul at Grand Cairo, an account of the process employed; but it contained no report of the marine salt or the urine. This information was in part afterwards confirmed, in part rectified and enlarged, by Paul Lucas Grainger, otherwise known by his proper appellation of Tourtechot. The evidence of those most respectable tra-

⁴ Vide proofs quoted in Gemlin's *Geschichte der Chemie*, ii. p. 69.

⁵ *Memoires de l'Acad.* 1720, p. 193. Basil Valentine, it is said, had before that time taught how to separate volatile alkali from sal ammoniac, by means of fixed alkali.

vellers, Shaw, Pococke, Norden, Hasselquist, Niebuhr, and Mariti, have since confirmed the preceding recital.

There want not writers who have asserted, that this article comes also from the East Indies; but as no evidence of it has been yet discovered in any papers relative to the trading concerns of the European India companies, such relations are not believed.

Reports have likewise been circulated, that it has been manufactured in Germany; but a German writer of great research into the trading interests of his country denies it, but, at the same time, admits that a spurious imitation may have been manufactured at *Bamberg*, and even Vienna, which, he says, was prepared from the sediment of the salt-pans and old urine. The only manufacture of this article in Europe which he recognises, is one that was established in Edinburgh, in 1756, by Dorin and Hutton, and which, he says, like many English manufactories was carried on upon a large scale. This he considers as one of the most modern, as well as the only European manufactory of sal ammoniac.⁶

APOTHECARIES.

During the progress of our inquiries, we have often cast a wistful glance at those whom we know are infinitely better qualified than ourselves to discuss many of our preceding themes, with that justice they merit. This impression has never visited us more strongly than upon the present occasion; but having undertaken to say something on this subject,—that respect we owe the public compels us to give the best information in our power. Since then we can only relate what we know, and testify of those things which we have seen, we proceed to furnish our information on this subject, and do it in the following manner.

Our old friend *Diodorus Siculus* is the first who willingly promiseth his assistance; and he informs us, that the *Egyptians* report that *Isis* found out many medicines for the recovery of man's health, being very expert in the art of physic, and contrived many remedies for that purpose.¹

In chapter vi. lib. 1, the same historian informs us, that in Egypt, to prevent diseases, they made use of clysters, (we have also somewhere seen that the origin of this idea was

⁶ Beckmann's Hist. article *sal ammoniac*, vol. iv. p. 303.

¹ Diod. Sic. lib. i. c. 2.

taken from the usual practice of the stork, or ibis; which bird, when ill, is observed to inject the water of the Nile up the usual passage,) and purging potions, abstinence, and vomits; and this they repeat sometimes for several days together, at other times, every third or fourth day: for in all manner of food, they say, the greatest part is superfluous, which breeds diseases; and therefore the aforesaid method, whereby the root of the disease is plucked up, they say, is a mighty help, better for the preservation and recovery of health; for the physicians have a public stipend, and make use of the receipts published by the law, made up by the ancient physicians; and if they cannot cure the patient by them, they are not blamed; but if they make other medicines they are to suffer death: inasmuch as the law-makers appointed such receipts for cure as were approved by the most learned doctors, such as by long experience had been found effectual.

The learned Dr. Sir Thomas Browne, in his *Pseudodoxia Epidemica*, in the chapter on vulgar and common errors, thus observes, “Physicians, many at least that make profession thereof, besides divers less discoverable ways of fraud, have made them (the public) believe, there is the book of fate, or the power of *Aaron's* breast-plate in urine; and, therefore, hereunto have they recourse as to the oracle of life, the great determination of virginity, conception, fertility, and the inscrutable infirmities of the whole body; for as though there were a seminality in urine, or that like the seeds it carried with it the idea of every part; they foolishly conceive, we (the physicians) behold therein the anatomy of every particle, and can thereby indicate their diseases, and running into any demands, expect from us as sudden resolution in things, wherein the devil of *Delphos* would demur, and we know hath taken respite of some days to answer easier questions.

“Saltimbalcoes, Quacksalvers, and Charlatans deceive them in lower degrees. Were *Æsop* alive, the *Piazza* at Venice, and *Pont Neuf* at Paris, could not but speak their falacies; meanwhile there are too many whose cries cannot conceal their mischief; for their impostures are full of cruelty, and worse than any other, deluding not only unto pecuniary depredations, but the irreparable deceit of death.”

The same author in chapter iv. book 1. of the same work, in his explication of the third cause of some popular errors, he has enumerated upon this division the *Aristotelian* causes of error, *A non causa pro causa*, observes,

“ Hereupon also are grounded the gross mistakes in the cure of many diseases, not only from the last medicine and sympothetical receipts, but amulets, charms, and all incantary applications, deriving effects from incurring causes, — but things devoid of all efficiency whatever.”

We have the circumstance fresh upon our minds which is mentioned by an historian; and to the best of our memory, the custom to which we allude, occurred in the capital of ancient *Persia*, where it was usual never to employ regular medicinal skill for the recovery of the health of the diseased, but only to carry the afflicted into the market-place, and each person who passed was compelled to give his testimony if he had ever seen any of his friends or acquaintance so afflicted; if he had, he was to declare what remedies had afforded the patient relief.

Thus far we found necessary to speak of medicinal practice generally; we now propose to confine ourselves to the specific article which heads this research; at the same time, lamenting that it is not treated of by a medical professor.

The present apothecary's business is one which rose from two or three other distinct sources. We now know that his business consists in keeping a repository of simples and compounds, galenical and chymical requisites; and his art teaches him to read the prescriptions of physicians, and to compound his medicaments agreeably to their directions.

But on searching the records of ancient Roman existence, we find that apothecaries were occasionally called *pigmentarii*, *septasarii*, *pharmacopolæ*, and also *medicamentarii*, with other nominations, serving more to distinguish the prevalence of the article wherein they dealt, than to mark any other distinction. However, that the *pigmentarii* dealt in medicines is established by that law which enacted a punishment for such as sold poison through mistake, *Digest*, lib. xlviii. Those herbs which are prescribed by *Vegetius* for certain diseases in cattle, were to be purchased of the *septasarii*. From *Pliny* it is also understood, these last named sold medicines, where he reproaches the physicians of his age, that instead of making up the medicines themselves, which appears to have been the ancient practice of Greece,² they purchased them of the *septasarii*, without knowing of what they were composed.³ The judicious of the Roman people

² In Greece it was usual for physicians to collect the simples themselves, as well as prepare compounds. A knowledge of astrology was also considered necessary to collect the plants in a proper planetary hour.

³ *Plin.* lib. xxxiv.

despised, we are told, the *pharmacopolæ* from their ignorant boasting. Pliny also informs us the *medicamentarii* were employed in a similar pursuit to the *pharmacopolæ*. In the Theodosian code, male and female poisoners were called *medicamentarii* and *medicamentariæ*. Those trades have been considered somewhat similar to our grocers, oilmen, druggists, and even mountebanks. It appears that the word *apotheca*, signified any store; the keepers of such magazines were accordingly styled *apothecarii*.

The error would be great, when we observe that word occur in writings of the twelfth and thirteenth century, if we should affix its present literal signification to the term; because at that period it was understood in its ancient sense, or at least it was applied to professed confectioners, who in the courts of princes made preserves, candied fruits, &c.

We do not know that the period is yet ascertained when the ancient physicians discontinued to manufacture the medicines they prescribed; but it is conjectured it took place among the Arabian faculty. This appears certain, should we believe the assertion of *Coming*, who expressly says, the physicians in Africa first began to give up the preparation of medicines, after their prescriptions had been given to other ingenious men; and that this was customary so early as the time of *Avenzoar*, in the eleventh century. Whence it appears pretty certain it commenced first in Europe, in Spain and the south of Italy. The Arabian or Saracen possessions or influence extending over that district, it is conjectured the practice was introduced by the physicians usually attending the Caliphs; whence the reason why numerous Arabic terms of art, as well as pharmaceutical and chymical denominations were introduced into European practice. Hence also, the probable reason why the first known apothecaries were found in the south of Italy. It is, however, concluded by a very respectable authority,⁴ that they obtained their first European establishment in consequence and by virtue of an eminent edict of Frederic II. issued for the kingdom of Naples, and from whence it is conjectured, by *Thomasius*, come the privileges they at present enjoy.

By that edict,⁵ we understand, it was established that

⁴ Beckmann.

⁵ This edict is to be found in *Lindenbrogii Codex legum antiquarum*, Francof. 1613, fo. p. 809, under the title *Constitutione Neapolitanæ seu Sicilæ*. The law here alluded to is *De probaliti experientia medicorum*; is generally ascribed to Frederic I.; but we understand *Coming* alleges it was enacted by his grandson Frederic II. Vide *Coming De Antiquitatibus Academias*.

the *confectionarii* should take an oath to keep by them fresh and sufficient drugs, and to make up medicines exactly according to the prescriptions of the physicians; and a price was fixed by which the *stationarii* might vend medicines so prepared, and keep them *a year or two for sale* in a public shop, or store. The physicians at *Salerno*, had the inspection of the stores of the *stationes*, which were not to be established in every or any place, but only in certain towns. That the *confectionarii* were those who made up the medicines, or *confectionary*, appears pretty evident; whilst probability favours our belief that the *statio* were the places where they were deposited for sale. It should be remarked, that the word *apotheca* very seldom occurs in that edict; even when it does, it evidently implies the warehouse where drugs were preserved; whence, *apothecarii* were evidently those who kept those warehouses.

The term *prescription*, in its physical sense, has also a meaning which we conceive may be adduced from the practice of that day; and perhaps from what we have seen in this article, it claims a more ancient descent; for at the period now under consideration, in Europe, as well as in Egypt, it should appear, that the drugs to be advised by physicians, and prepared by their ministers, the subaltern apothecaries, were in the first place *prescribed* specifically by the edicts or institutions of the respective governments. Whether this practice was likewise common in ancient Greece, Arabia, and Rome, we are not informed.

From the application of the same identical terms in the Roman pandects above mentioned, and their recurrence in the edict last spoken of, no doubt remains on our mind but the same sense was implied in both of those instruments; and our belief is farther strengthened from the following circumstances. After a physician had passed an examination, and preparatory to his having obtained a licence to practise, it became essential he should swear to observe *Formum curia tractenus observatam*; and if he found *quod aliquis confectionarius minus bene conficiat*, he was obliged to give information to the *Curia*. In their turn, the *confectionarii* swore they would make up *Confectiones secundum prædictam formam*. It was likewise necessary that electuaries, syrups, and other medicines should be accompanied with a certificate from a physician, to show that they were properly prepared.

To many it may appear somewhat extraordinary that this edict alludes only to certain medicines commonly employed, which probably had been previously fixed upon

from the writings of *Hippocrates*, *Galen*, *Misaries*, the work of *Actuarius*, or *Avicenna*, *Nicolaus*, *Myrepsius*, and *Præpositus*; their several writings having been collected by *Nicolaus di Riggio*, a native of *Calabria*; since translated by *Dr. Moshen*, in an eminent work called *Antidotarium*. This formed the *Pharmacopia* as well as the *Medical Institutes* of *Salerno*.

Conjecturing the separation of pharmacy from medicine took place in *Africa*, as previously stated, it is extremely probable the celebrated *Constantius Afer* had been instrumental in its introduction to Southern Italy; who being a native of *Carthage*, and learning the art of medicine from the *Arabians*, made it known in that country, subsequent to 1086; when, he being a *Benedictine* monk, in the monastery situated on *Mount Cassino*, the service he rendered by his skill to the physical school in the neighbouring cells of *Salerno*, the records of that local spot bear ample testimony.

After this time, it became the fashion in monasteries for their incumbents to learn the healing art; at least, so far as to prepare medicines. They accordingly officiated for the rich and took a fee, but served the poor *gratis*, except when they wanted expensive medicines.

The holy see, observing the benefit which would accrue to it, and how much its influence would be extended by the universal practice of introducing the faculty of medicine in its institutions, lost no time in availing itself of so much additional interest; in consequence, the practice became universally prevalent in all religious societies on this side the *Alps*, the same as it had become common in the south of *Italy*.

It appears that medical establishments were formed every where in *Europe*, upon the plan of that founded at *Salerno*. But specific and particular places were also necessary in most other countries as well as *Italy*; and as the physicians had hitherto used no other drugs than those recommended by the ancients of *Greece* and *Rome*, and many of these were to be only procured in oriental climates, it became necessary to send thither for them: accordingly, factories, agents, and warehouses were established in many parts of *Greece*, *Arabia*, and *India* for this purpose. To effect all this would have been impossible, without dividing the employment; because the learned physician was employed in his own immediate avocation; therefore convenience and accident uniting, the practice of submitting to necessity in the employ of ingenious persons to perform

those subsidiary arts, became indispensable. Monopolies in certain articles also became the necessary consequence; the preparation of drugs, likewise, from necessity too, constantly acquired additional expense.

Soon after the practice of physic had become thus general, and in proportion to new discoveries in that art, the sacred science of chymistry arose; and as the erection of furnaces, and the fitting up of laboratories was also necessarily expensive, in justice it certainly became proper that those who had incurred just charges, should be indemnified in some way; the most obvious was, therefore, to restrict the sale of those articles they prepared to themselves, or their acknowledged agents. It, therefore, tacitly followed, that pharmacy next was separated from the physician's practice.

The art of the apothecary, as has been suggested, in the infancy of this revived art in Europe, was also employed, as well in preparing physical compounds as in manufacturing those delicacies which are now made by confectioners and cooks.

In most large and opulent cities, those medical establishments were made and supported at the public expense, and were under the direction of the magistracy. Independent of the warehouse of the apothecary, and the laboratory of the chymist, it was also customary for them to have a physical garden, for the cultivation of certain choice, and perhaps exotic plants and simples.

In the courts of princes and other great persons, it was usual for princesses and the ladies, the consorts of such personages, to have the appointment of the apothecary to the establishment; and it has been archly remarked, that it is known when ladies have lost the power to kill, they feel a disposition to heal, and benevolently to attend to the preparation and dispensing of medicines. The fact is, when the female mind has seen the futility of those little arts they were taught to appreciate in infancy, and which disposition had "grown with their growth and strengthened with their strength;" the divine principle of benevolence is so strongly implanted in their nature, and which nothing but false education had endeavoured to smother; at this period alluded to, their reason fully resumes its empire, and they only follow the natural bias of a mind divinely attuned to all the harmony of humanity in actions which ennoble the moral character of rational existence; for as Homer expresseth by the medium of *Nestor*, a more than oracular truth, when he says, on seeing *Machaon* carried wounded off the field:

“ A wise physician skilled our wounds to heal,
“ Is more than armies to the public weal.”

Iliad xi. *Pope's Translation*, v. 637.

The first mention we find made of apothecaries in our English records, occurs in *Fædera*, whence it appears that in the year 1345, Edward III. gave a *pension* of sixpence per day to *Coursus de Gangeland*, an apothecary in *London*, for taking care of, and attending his majesty during his illness in Scotland.

Of apothecaries in France, no mention occurs, as we are informed, anterior to the year 1484, that being the period when they received their first charter from Charles VIII.⁶ Others they received in 1514, from Louis XI.; in 1516 and 1520, under Francis I; in 1571, from Charles IX.; in 1583, from Henry III.; in 1594, from Henry IV. All which regulations were confirmed, and these charters consolidated by Louis XIII, in 1611, 1624, and 1638.⁷

We are indebted to Beckmann's recent learned work, intituled *Beckmanns Beyträge zur Geschichte der Erfindungen*, 5. v. 12mo. for the following information, as to continental apothecaries, respecting the subject of the present article; we have to hope that our immature acquaintance with the original language may not have prevented our rendering his sense: and, accordingly, place ourselves upon the liberality of the public.

Sattler, in *Geschichte Württenbergs unter den Herzogen*; *Weisser*, in *Nachrichten von den gesetzen des Herzogthums Württemberg*; and *Von Stetten* have severally ascertained the following particulars relative to German apothecaries. As early as the thirteenth or fourteenth century, Von Stetten conjectures, from the records of the city of Augsburg, that apothecaries' shops were established in that city; an apothecary's shop being kept by a female, who was paid a salary by the city. Mr. Sattler informs us, that in the beginning of the fifteenth century an apothecary's shop was opened at *Stutgard*, by a person named *Glatz*, at that time the only one in the country; it was first sanctioned by the Count de Wirtemberg, in 1458. In the patent granted on that occasion, it was said, that *Glatz's* ancestors had for many years kept an apothecary's shop at *Stutgard*, and had furnished it as an apothecary ought. In 1457, Count Ulric gave to Mr. John Kettner, whom the year before he had appointed his domestic chap-

⁶ Histoire de Paris, par *Sauval*, v. ii. p. 474. Histoire de Paris, par *Felibien*, v. ii. p. 927. Traité de la Police, par *De la Mare*, v. i. p. 618.

⁷ Dictionnaire des Arts et Metiers, par *Joubert*, v. i. p. 105.

lain, leave also to open an apothecary's shop at Stutgard; and promised to allow of no other in his dominions. The apothecary received yearly from the Count a certain quantity of wine, barley, and rye; but he, on the other hand, engaged to supply the court with as much *confectionary* as might be required, at the rate of twelve schillings per pound.⁸

Both these shops seem afterwards to have been abandoned, and the Count and apothecary to have entertained the same opinion, that each could renounce his contract when he pleased. In the year 1468, one *Albrecht Mulsteiner*, or *Altumsteiner*, from *Nuremberg*, was appointed apothecary, with a promise that no other private or public shop should be tolerated, except that at *Wirtemberg*. The patent is similar to that given to *Kettner*, with this difference, that it contains in addition, a catalogue of the different articles, with their prices.

An apothecary's shop is mentioned at *Tubingen*, under Count *Everhard*, as an hereditary fief; the possessor of which bound himself to serve as physician and apothecary to the army in time of war.

In the year 1500, *Ulric* of *Wirtemberg* allowed one *Syriax Horn* to establish an apothecary's shop at *Stutgard*, and appointed him apothecary for six years. He was obliged to swear that he would supply government and all public officers, as well as the Duke's subjects, with medicines; and the body physician was enjoined to visit the shop once every year, in order to examine whether *Horn* conducted himself according to the regulations laid down for him, and sold his medicines at the fixed prices.

In 1559, there were four apothecaries appointed in this duchy, *i.e.* at *Stutgard*, *Goppingen*, *Kalw*, and *Bintigheim*, which were then, and still are called, the land apothecaries. At that time there was also an apothecary's shop established in the ducal palace at *Stutgard*; which the consort of Duke *Christopher* caused to be furnished at her own expense; from whence the poor received, *gratis*, whatever medicines they wanted.⁹

The first apothecary's shop at *Hamburgh*, belonged to the

⁸ Damit wir und die unsern und auch fust menglich, der die bruchen wirdet, versehen sy und die materyen und spetzyen, was das ist, das ein appentecker haben soll, das soll er geben als zymlich und gewonlich ist in andern appentecken am nechsten umb unser land gelegen. . . . Er soll uns auch gut gemein confect geben so vil wir bedorfen und zu im niemen werden, und sollen wir im geben fur ein pfundt sollich confect zwolf schilling heller. *Sattlers Geschichte des Herzogthums Wirtemberg unter den Grafen*, vol. v. p. 159. Addenda, p. 329.

⁹ The humane dispensation of medicines by the Chinese should not be forgotten. In the public square of their cities they have a stone raised, of the height of ten

council of that city: when it was established we cannot with certainty determine, but that it existed there before the sixteenth century is very apparent; and also, it is equally certain that it was situated near the Exchange and Council-house, and that it had, according to the usual custom, a garden belonging to it in the New Town. Also, anterior to A.D. 1618, there was a private establishment of that kind. In 1529, there was a city physician established; from thence quacks and mountebanks were banished.

The most ancient regulation for apothecaries in that city, was made in the year 1586, as we collect from *Nucleus recessuum Hamburgens.*

Anterior to 1472, apothecaries were legally established at Frankfort on the Maine; for at that period the magistracy of Constance, requested to know what regulations were made there concerning the prices of medicines. In 1489, the city physician was instructed to inspect them carefully, and see proper prices affixed to different articles. In 1500, all the apothecaries there were compelled to swear to observe the regulations prescribed for them. In 1603, a decree was promulgated that no more apothecaries' shops should be allowed than the four then in existence,

In the general police regulations prepared at Basle, A.D. 1440, it was established, that there should be appointed in every German imperial city, a physician, with the allowance of an ecclesiastical benefice, or canonry, in order that he might exercise his art *gratis*. It is therein said, "What costly things people may wish for from the apothecary's shop, they must pay for;" thence Dr. *Mohsen* concludes, that common roots and herbs only were used in apothecaries' shops, and that expensive drugs and compounds were brought from other and distant countries.

The first apothecary's shop known in Berlin, is mentioned in the King's feudal records, to have been established in 1488; at which period, the magistrates gave one Hans Zehender a right to hereditary possession of a shop, and promised to allow him yearly, in order for support, a specific quantity of rye, with a free house; and engaged also to exempt him from all public contributions, watching, and other burdens, and to permit no apothecary to reside in that city; which agreement was confirmed in 1491, by the Elector John; and also again in 1494, by the Elector

cubits, on which is engraven the names of all the medicines they use, with the prices affixed; the poor who require relief from physic, go to the public treasury, where they have the money given to pay for what physic they want.

Joachim I. who, on coming to the government, gave the apothecary a new patent, in which was stipulated that his body physician should take care the shop should be furnished with proper drugs; that the medicines to be furnished to the Elector, and his court, should be made up according to the prescriptions, and that he should not charge above the regulated prices.

We are assured that at *Halle*, in Saxony, there was no apothecary's shop till 1493. Before that period, medicines were sold by grocers and barbers only. In that year, it appears, the council, with the consent of the Archbishop, permitted one Simon Puster to establish an apothecary's shop; in order, as the patent states, "That the citizens might be supplied with confections, cooling liquids, and such common things, at a cheap rate; and, that in case of sickness, they might be able to procure, readily, fresh and well prepared medicines." By it Puster was exempt from all public taxes and contributions for ten years, with this proviso, that during that period he should furnish yearly, at the council house, for two collations in the time of festivity, eight pounds of good sugar confections, proper to be used on such occasions. It was also stated, that in future, no kind of preserves made with sugar, or what was called confectionary, or *theriac*, should be kept for sale, or sold either in the market, or in booths, shops, or stalls, except at the annual fair. This was the only apothecary's shop in that city till 1535, when the Archbishop gave his physician, J. N. Von Wyhe, liberty to establish a new one, with an assurance that *to eternity* no other should be established or permitted in *Halle*; which declaration was confirmed by the chapter! However, notwithstanding the *eternal* promise of the Archbishop, confirmed by his clergy, one Wolf Holzwirth, a skilful apothecary, who had lately returned from Italy, found means to procure permission, in 1555, to establish a new, and the third apothecary's shop.

In 1409, at the period the university of Prague was transferred to *Leipsic*, and things were put on the same footing in the latter city as had been in the former; among other things, an apothecary's shop was likewise founded, and known by the same name as that at Prague had been; it was called the *Golden Lion*.

In 1560, an apothecary's shop was established at *Eisenach*. At this period there was none for the court of the Duke John Ernest, who died in 1638. Till then the office of apothecary had been supplied by one of the yeomen of the jeweller.

In 1598, Count John Von Oldenburg caused an apothecary's shop to be established at Oldenburg, for the general good of the country.

In 1565, an apothecary's shop was established in *Hanover*, near the Council-house, under the auspices of the consort of Duke Philip, of the House of Grubenhagen, a princess of the House of Brunswick, married A.D. 1560, who, with a most commendable charity, supported in her court an apothecary's shop and a still-house, for the benefit of her servants and the poor. The *Letzners Dasselsche und Eimbecksche Chronica*, printed at Erfurt, A.D. 1596, furnishes the following motive for this establishment: "By her apothecary's shop and still-house, one may discover what real compassion the Christian Electress showed towards the poor who were sick or infirm; as by having medicines prepared, and causing all kinds of waters to be distilled, she did not mean to assist only her own people, and those belonging to her house, but the poor in general, whether natives or foreigners; and not for the sake of advantage or gain, but *gratis*, and for the love of God." Duke *Julius* came to the government of Brunswick, in 1568; he caused apothecaries' shops to be established in his territories; and his consort, daughter of the Elector of Brandenburg, in imitation of the last-named Electress, kept for the use of the poor, an expensive apothecary's shop in her palace; and the citizens of *New Heinrichstadt*, near *Wolfenbittel*, when afflicted by any epidemical disease, or *dysentery*, *quinsey*, *scurvy*, or *stone*, were directed to be supplied from it with medicines free of expense.¹⁰

An apothecary's shop, at the court of *Dresden*, was founded by the Electress *Ann*, a Danish princess, A.D. 1581. In 1609, it was renewed by Hedwig, widow of the Elector Christian I; and in 1718, it received very great improvements.

Gustavus Erickson, King of Sweden, first established an apothecary's shop in Stockholm, his capital; and on the 20th of March, 1547, he requested Dr. *John Audelius*, of Lubec, to send him an experienced physician and a good apothecary. On the 5th of May, 1550, his body physician

¹⁰ This account, our authority says, is extracted from information collected by Professor Spittler, in the *Geschichte der Fürstenthums Hannover*, from the Gottingen press, 1786. That the council of Gottingen very early paid great attention to the medical art, the following passage from the *Gottingischen Chronike* of Franciscus Lubeus, will evidence: "A. D. 1380, the city procured a surgeon from *Eschwege*, who with his servant, was to be exempt from contributions and watching, and to receive clothes yearly from the council." See *Beschreibung der Stadt Gottingen*.

received orders to bring a skilful apothecary into his kingdom. When this prince died, in 1560, he had no other physician with him than his barber, *Jacob*, an apothecary named *Lucas*, and his confessor, *Johannes*, who also, as was usual among the Roman clergy, practised physic as well as prescribed for his majesty. Lucas, it appears, was his chief apothecary.

At Stockholm, also, on the 21st of March, 1575, King John appointed one Anthony Busenius apothecary at his court; and in 1623, Philip Magnus Schmidt, a native of Langensalza, in Thuringia, was chosen to fill that office. In 1675, there were five apothecaries' shops in Stockholm. Ever since 1694, there have been nine.

The first apothecary's shop at Upsal, was established in 1648, by one Simon Wolimhaus, also a native of Thuringia, and from whom the present family of Count Gyllenborg are descended.

Towards the end of the sixteenth century, physicians and apothecaries were first invited into Russia by the Czar *Boris Godunow*.

At the Byzantine court, at an early period, the keeper of the wardrobe, as we have seen the yeoman of the jewellery at Eisenach in the sixteenth century, had the care of the portable chest of medicines, when the Emperor took the field. It was then called *pandectæ*, and contained *theriac*, with antidotes, and all kinds of oils, plasters, salves, and herbs proper for curing men and cattle.

The *Apothecaries' Hall*, in London, was incorporated by charter from James I. on the solicitation of Drs. Mageme and Atkins:—till which time, in London, there had been no regular apothecaries; the venders of medicine were incorporated with the grocers, and usually sold plums, sugar, spice, Venice treacle, mithridate, &c. From their ignorance, people had unwholesome medicines imposed on them, as appears from a case stated of William Rose, in *Rees's Cyclop.*

In the commencement of the present century there were established, in London, numerous charitable foundations, in addition to the public hospitals, called *dispensatories*, for supplying the poor, *gratis*, with medicines; and these dispensatories also furnish skilful physicians and surgeons to attend them at their own dwellings. The names and number of public hospitals in this metropolis, are as follows:—1st. St. George's; 2nd. St. Bartholomew's, founded by Edward VI.; 3d. Middlesex; 4th. Westminster; 5th. The London; the United Hospitals of St. Thomas's and Guy's,

with several other lesser establishments for lying-in women, &c. &c.

AQUAFORTIS, NITRE, SODA, ALKALI, POT-ASH, AND GUNPOWDER.

Our saltpetre, commonly called *nitrum*, or sometimes *sal nitri*, is a neutral salt, from its peculiar acid,—an acid commonly called the *acid of saltpetre*, and that vegetable alkali to which our pot-ash usually belongs; the chief marks which distinguish it from other salts are, its cooling taste, its fusibility when exposed to even a moderate degree of heat, and its peculiar decrepitation, that is, the property, on being placed in the fire, or any ignited body, of sudden combustion in a very bright flame, by which it becomes alkalised, or loses its acid; so that nothing remains but the vegetable alkali. Its chief use in the works of art is in the manufacture of gunpowder, and the preparation of the well-known acid termed aquafortis.

AQUAFORTIS is a caustic useful in various arts, but particularly as a *metallic test*, and in the engraving of various metals; but, however, more peculiarly used in the elegant art of multiplying pictures, called copper-plate engravings. The workers on metals, distinguish it into two kinds, called *prima* and *secunda*; the former of these is the pure nitrous acid, and the latter is the same acid dilated with an equal portion of pure water.

The basis of this acid (properly prepared) is from a mineral alkali, a neutral salt, of which there are three chief species found in the calx of the minerals following, and called nitre of *silver*, called also lunar crystals, of *lead*, and of *mercury*.

It appears to be a point by no means settled among naturalists, whether the substance known as *nitrum* to the ancients, was the same we denominate *saltpetre*. But upon the most obvious comparison of the specific nature of both substances, the prevailing opinion appears to be, that what *Theophrastus* and *Pliny* knew by the name of *nitrum*, is the article we now denominate *soda*; under which general name are included a great variety of salts of many specific natures.

Almost all the saltpetre obtained in Europe,¹ as its pro-

¹ Of saltpetre in Russia, or, at least, in Siberia, there are such immense quantities raised, that there are annually delivered into the Emperor's storehouses thirty

duce, generally, is said to partake of the properties of that before described, and also of that which is obtained, by the process of chymical art, from organized animal and vegetable substances. As the putrefaction of organized animals, under certain circumstances, is discovered to yield large portions of nitrous acid, and as that acid, generally, readily combines with *calcareous* earth, wherever it finds it, this combination being decomposed with fixed vegetable alkali, when the nitre produced from this process is called common saltpetre. Sometimes, also, it is discovered that nitrous acid is mixed with some one of the three calx before specified, from which is procured a saltpetre known as *cubical* saltpetre.

These mineral calx, united with nitrous acid, are found in several places in Europe, the East Indies, and America.

There is also a species of saltpetre brought to Europe from Egypt, as an article of commerce, which is said to be produced in part by certain earths found in India, Africa, and particularly Egypt, like that which covers the old rubbish hills in the road between New and Old Cairo, and likewise in numerous parts of Spain.

It has been conceived by authors, presumed to have been well informed themselves on this subject,² that this earthy saltpetre produced from extreme heat of solar efflorescence, was the only subject known as *nitrum* by the ancients. Which opinion appears probable, if the ancient nitre be considered to be what we at present call *soda*, as there is also adequate room to suppose it partook of, at least, a very material feature of this substance; because the *sal nitrum* of the ancients is found to have been used to cleanse in washing generally; we have seen in a passage before cited on *Feasts*, that it was customary to wash with nitre after supper. Soap was not then discovered; this substance is still used by our laundresses for the same purpose. Its alkaline or dissolvent qualities, proclaiming its utility for these purposes.

Originally, there is the largest extent for presumptive proof, the ancients were content with only one or two resembling properties in substances, to give them one general

thousands poods from *Astracan*. Not far from the river *Isett*, in Siberia, there is likewise a lake, where, in the summer, a third part of saltpetre is mixed with the common salt produced round its shores. In that place, wood being scarce, it will not answer the cost to separate the saltpetre from the salt, which must be done by boiling. There is also much sulphur found in common rocks of talc, in the kingdom of *Casan*, as fine and clear as amber. *Strahlenberg's Hist.-Geog. Description of North and North-East of Europe and Asia*.

² Particularly Professor Beckmann, vol. iv. p. 532.

appellation; this mode of classification agreed with their primitive simplicity. But the industrious and laudable ambition of their successors, has paid more attention to these things; and those objects of natural history also of late years, and since the time of our great naturalists, and Linnæus in particular, have obtained a more correct and specific classification, being distinguished first into genera, the grand distinction of antiquity, next into families or species, and even into individuals of that species. It appears, that originally the elephant and rhinoceros were both known by the generic name of oxen; whilst the sable and the ermine were denominated mice. The ostrich was also denominated by the title of the *struthio-camelus* or *passer-camelus*, *i. e.* sparrow camel, and was classed with that small bird, as this name imports. Only, that according to Egyptian or hieroglyphical configuration, presuming the heterogeneous union of two opposite natures, were, perhaps, first assigned by the learned in the syntaxis of nature, which spoke to the mind by pictural representation, and that, perhaps, only allegorically; but here the ancients discovering a bird of such immense power and of so large a size; and also being found to exist in the only country where camels are indigenous; likewise from its seldom using its wings, except to assist it in its passage on its feet through the deserts, like Milton's *Armaspasi*, the union of a heavy quadruped and a volatile winged animal, were not unaptly conjoined.

It is also alleged, that the ancients were not acquainted with the mode of separating and distinguishing salts, and that they were equally ignorant of many other of the mineral and concealed productions of nature; this seems also probable, from the admitted discoveries which have been since made by the moderns, particularly in the properties of gases and other mineral productions, which can be only procured by the chymical assistance of certain degrees of ignitious power. A discovery that was retained for the now exploded endeavours of alchemy to produce; which art exceeded its own most golden expectations in its consequences, although it did not attain its avowed and specific object.

It is well known that in warm countries, as hath been already suggested, the alkali effloresces here and there in exhalations from the earth, even in sufficient quantities to attract the attention of the commercial world. Hence, then, it may be easily conceived why these saline parts, which are often found mixed with particles of common salt, obtained the general appellation of *nitrum*.

SODA.—It was an important discovery made by the mo-

derns, that a similar salt having the like properties and applicable to the same purposes, could be obtained from the *ashes* of certain plants, called SODA, so named, perhaps, from it being of the alkaline or saline fraternity, as there are many plants which possess, in a greater or less degree, the properties of those minerals in whose calx they are found; to instance, what has been said in certain authors, of pinks, —that a perfect particle of steel has been discovered in this plant; it is not so much to be wondered at, when we know that the ferruginous particles communicate to that delightful plant its various tints of a purple, red, and scarlet colour: the same may be said of the rose, and indeed of all plants which participate of their family sanguine colour. Iron, through nature, communicates this colour to every thing where it is found; even the blood of animals is discovered to be made of this hue by the chymical preparation of iron, suffused through the sustaining juices of animals, the nutritive juice of plants, as prepared in the laboratory of nature, to commix with the finest and most subtle juices of animals and plants, as discovered by that test of natural truth, *analysis*, in that portion of their recipient nutriment they obtain from the providence of nature's God. To the excess of this component, intended to fortify the inhabitants of the torrid zone, to enable them to support themselves under the intense influence of the heat from a tropical sun, and the transparency of the exterior cuticle, renders their appearance either black or intensely red,³ as we have seen in a preceding article on *Physiognomy*.

ALKALI.—It has been thought, by the judicious Professor Beckmann, the neutral salt obtained from vegetable *kaline* substances, and which appears to have been invented and also named by the Arabian and Egyptian chymists, and with the addition of the Arabic article, *el*, or, as substituted by Europeans, *al*, now known as *alkaline*: likewise, also, known well to the *Greeks*, was first generally classified as *nitrum*, or, at least, considered by them as a proportion or species of it. In another place, (p. 534 and 535,) the same sagacious author remarks, from St. *Jerome*, that it may be questioned in the etymology of this name, whether the

³ Such is observed to be the appearance of the Ethiopians, and other distinct tribes of various nations of the inhabitants of Africa. Hence, we are told, *Tippo*, or *Typhon*, was red, as it is said this *name* imports redness in the language of ancient Egypt. Hence, also, arose the usual practice of the Egyptians to sacrifice *red men*, —or men with red hair, at the altar of OSIRIS, and whence was also derived the general report of the cruelty of the Egyptian *Busiris*, as *Brown*, in his *Pseudodoxia Epidemica*, and other authors, informs us.

name of the salt, *nitrum*, was derived from the Egyptian name, a province *Nitra*, where, he says, it was obtained in great abundance, or whether the province derived its name from that substance. Among the Greeks, *Galen*, we believe, asserted that by incineration, this alkali became slightly caustic, becoming also deliquesced if exposed to the air.

In a similar manner saline ashes were obtained from other plants, although, perhaps, essentially different from the former; those salts last alluded to, in process of time, obtained among Europeans the name of POT-ASH, by which is understood the vegetable alkali.

For previous reasons, it may not appear strange that the distinction of mineral and vegetable salts, or alkaline substances, was not made by the ancients, especially when it is considered, that they occasionally obtained salts from vegetable and mineral substances. There is reason to suppose, they also considered the saline incrustation of old walls, called by the Levitical⁴ law the plague of houses, as common with the other saline substances, and that they denominated this *nitrum* also. All those species of this salt, it is probable, they used for the domestic purposes of washing, and thence farther may be thought to be referred unto by the prophet Jeremiah, ch. ii. v. 22, and likewise in the Proverbs of Solomon, ch. xxv. v. 20, also in Malachi, ch. iii. v. 2. The antiquity of this name is unquestionable from these texts, and also from one of the early fathers of the Christian church, who thus expresseth himself on a passage in Proverbs, ch. xxv. v. 20. “*Nitrum a Nitria provincia, ubi maxime nasci solet, nomen accepit. Nec multum a salis Ammoniaci specie distat. Nam sicut salem in litore maris fervor solis conficit, durando in petram aquas marinas, quas major vis ventorum, vel ipsius maris fervor in litoris ulteriora projecerit; ita in Nitria, ubi æstate pluviae prolixiores tellurem infundunt adest ardor sideris tantus, quod ipsas aquas pluviales per latitudinem arenarum concoquat in petram; salis quidem vel glaciei aspectui simillimam; sed nil gelidi rigoris, nil salsi saporis habentem, quæ tamen, juxta naturam salis, in caumate durare, et in nubiloso aere fluere ac liquefieri solet. Hanc indigenæ sumentes servant, et ubi opus extiterit, pro lomento utuntur. Unde Judæo peccanti dicit propheta Jeremias: si laveris te nitro, et multiplicaveris tibi herbam borith, maculata es in iniquitate tua, dicit Dominus Deus. Crepitat autem in aqua quomodo calx viva; et ipsum quidem disperit, sed aquam lavationiabilem reddit; cujus natura cui sit apta figuræ, cernens Solomon ait: Acetum in nitro, qui*

⁴ Leviticus, ch. xiv. v. 33.

cantat carmina cordi pessimo. Acetum quippe si mittatur in nitrum, protinus ebullit.”

As the above extract from St. Jerome is often referred to, it is inserted here in the original, to afford the public an opportunity to form their own opinion.

We should not omit to mention, that Herodotus, in that passage where he describes the method the Egyptians observed in embalming dead bodies, also mentions *nitrum* as an ingredient used. Some Greeks, it is said, pronounce this word *litron*.

Men, in the course of time, are said to have become acquainted with the purer and more useful, at the same time, more easily to be acquired, mineral alkali, which was furnished under the name of *soda*, by the Moors and inhabitants of southern Africa, who had learnt the method of preparing it. The vegetable alkali was also frequently manufactured in their woody-districts, and became an article in great request, and was sold under the name of POTASH, *cineres clavellat*.

From those improvements all knowledge of the impure alkali from the incrustation of walls fell into disuse; and there being no further occasion to guard against the confusion resulting from names, it was thought no longer necessary to name saltpetre *sal nitre*, it was called *nitrum*; the oldest signification of this word by degrees being forgotten, it was admitted, without further examination, that the *nitrum* of antiquity was nothing more than our saltpetre.

Those learned and scientific travellers, Peter Belloni and Prosper Alpinus, travelling through the east in the vicinity of Byzantium, in the fifteenth century, heard the article of mineral alkali, hitherto called *nitrum*, denominated by the inhabitants of that district NATRUM, they introduced this latter name into their works, whence the change of nomenclature took place.

Linnaeus, in 1736, also adopted the same term in his classification of mineral alkalies; in this he was followed by Wallerius, who also includes the oriental mineral. After these illustrious examples, the word *natrum* has been generally adopted by subsequent geological writers.

It affords us pleasure to remark, that in the early part of the last century, our own ingenious countryman, the Hon. Mr. Boyle, had examined and determined the difference between the fixed and volatile alkalies: however geologists and chymists, till the latest periods, believed all fixed alkali was produced by the incineration of vegetables; to determine this and fix it upon the public mind, however, we are

indebted to the labours of those eminent German chymists, *Pott*, *Model*, and *Maggraf*; and especially after the year 1758, when the latter had proved that the basis of common salt was not, as had been hitherto believed, an alkaline earth, but a fixed alkali: because it was in many of its properties different from the fixed vegetable alkali.⁵ Soon afterwards the substance was discovered in mineral springs, which has since been proved by *Model* and others, that it is not essentially different from what is in the east called *natrum*. It certainly appears that the *nitrum* of the ancients and the *natrum* of the recent Orientalists, are only different *pronunciations* of the *same* word.

We now advert to the more ancient and general mode of obtaining alkaline salt. The near affinity of wood-ashes to the *nitrum* of the ancients, which is universally acknowledged from the evidence they have left us of its properties and effects, proves also that it was a lixivious salt. *Theophrastus* says, that *nitrum* was understood to be the produce of oak-ashes; and *Pliny* after him remarks, that it was certain the ashes of that wood were nitrous. He also ascribes the same property to the burnt lees of wine. He also considers as a species of *nitrum* those ashes, which in countries destitute of salt, were used for seasoning food, and which was prepared by pouring sea or salt water over burning piles of wood gradually and in small quantities, so that the fire should not become extinguished, by which process the water evaporated, leaving the salt behind, but indeed mixed with charcoal, ashes, and lixivious salts; consequently, it must have been moist, or perhaps nauseous, if not refined or cleared by some new process. This method of preparing salt, which is, perhaps, the most ancient which the various writers on the subject have mentioned, from a want most likely of actual observation, they have not left us specific information, whether it was sea-water or brine that was employed, but speaking in such a manner as if any kind of water answered the same purpose.

Varro reports that he saw the last described process employed on the Rhine.⁶ *Pliny* says,⁷ that oak-timber had been before burnt for that purpose. Also, in another place,

⁵ Chymisches Schriften, i. 169.

⁶ "In Gallia transalpina intus ad Rhenum, aliquot regiones accessi . . . ubi salem nec fossicium nec maritimum haberent, sed ex quibusdam lignis combustis carbonibus salsis pro eo uterentur."—*De Re Rustica*, lib. i. cap. 7. Little, however, depended on the wood; the chief thing was sprinkling it with water.

⁷ "Quercu cremata nunquam multum factitatum est, et jam pridem totum omissum." xxxi. 10.

he likewise describes a similar process among the Gauls and Teutones.⁸ And Tacitus, in his *Annals*, xiii. 57, bears evidence that this method was observed among the *Herman-duri* and the *Catti*.⁹ Pliny also states, upon the authority of Theophrastus, that the *Umbri* burned salt in the same manner. And although Pliny has asserted that this early method of obtaining salt, had been then long given up, in consequence of the superior arts which civilization had communicated to humanity; it is now ascertained that it was long continued in many countries, and it is even at this day said to exist in some certain districts.

We are told, that about two centuries ago the inhabitants of the province of Zealand, descendants, perhaps, of the *Catti*, had no other salt than what they obtained in like manner from mud, thrown up by the sea, which they dried, burned, and moistened with water; as we have it from *Lemnius*, who was himself a native of that country. It is also related by *Boxhorn*, in his annotations on the preceding passage from *Tacitus*, that he saw a painting at Zirkzee, in which the whole process was represented.

That the express period when *nitrum* was first discovered is extremely uncertain, may appear from what has preceded; also that this *nitrum* was an alkaline salt, may, perhaps, have been proved. It has been, indeed, conjectured that it was a component part of the *Greek fire*, invented about 678, which has been believed to be the origin of *gunpowder*. From the oldest prescriptions which have been found, and which is said to have been that given by the Princess Anna Commena, in which, however, only resin, sulphur, and oil, are mentioned; saltpetre does not appear.

It is believed by an author very well qualified to form a judgment on the question,¹⁰ that the first certain account we have of *saltpetre* by that express name, occurs in the oldest account of the invention of *gunpowder*, which, according to him, occurred in the thirteenth century. Dr. Rees, in his *Cyclopædia*, expressly says, about the year 1320; and that it was first used by the Venetians against the Genoese, in 1380; also that it was first employed in Europe at a place anciently called *Fosse Clodia*, but now known as *Chrogia*,

⁸ "Galliæ Germaniæque ardentibus lignis aquam salsam infundunt. Hispaniæ quadam sui parte e puteis hauriunt, muriam appellant." Lib. xxxi. 7. Here brine is expressly mentioned.

⁹ "Illisque silvis salem provenire non ut alias apud gentes eluvie maris arecente unda, sed super ardentem arborum struem fusa; ex contrariis inter se elementis igne atque aquis concretum." *Taciti Ann.* xiii. 57.

¹⁰ Professor Beckmann, vol. iv. p. 569.

against Laurence di Medicis; and the last named authority adds, "That all Italy made complaint against it, as a manifest contravention of the law of arms." The Cyclopædia gives the following *recipe* for its manufacture, without distinguishing the proportionate parts. "A composition of nitre, sulphur, and charcoal, mixed together, and usually granulated:" describes its effects by observing, that "it easily takes fire, and when fired, rarefies and expands with great vehemence by means of its elastic force;" also that "it may be made without *nitre*, by means of marine acid."

Gunpowder is so plentiful in Russia, from the great quantity of saltpetre raised in Siberia, that it is sold at 60 kopecks per pood, about 40 lbs. weight, which does not amount to one penny per pound.

It appears that we have preserved to us two accounts of the original of this invention. And the first of which was given by our illustrious countryman, *Roger Bacon*, called *Dr. Mirabilis*, the wonderful Doctor, who died in Oxford, anno 1278; and another by *Albertus Magnus*, intituled *De Subtilitate*, xiii. 3, p. 71. ed. Francf. 1612.

It is said to be doubted whether Albertus was the author of the book which bears his name; but that he, whoever he may have been, and Bacon are presumed to have taken their information from the same identical source. About the period of the invention of gunpowder, it appears the art of making the Greek fire began to be lost. In the works of Bacon, the term occurs, at least, three times.¹¹ According to Casiri, the term *pulvis nitratus*, is to be found in an Arabic MS. the author of which existed about 1249. If the work of GEBER, *De Investigatione perfectionis*, be genuine, and if this writer lived, as has been thought, in the eighth century, it would be the oldest where saltpetre is mentioned, in a prescription for an *aqua solutiva* or *dissolutiva*, which appears to be almost *aqua-regia*.

The author we consult, says he is inclined to believe that gunpowder was invented in *India*,¹² and brought by the Saracens from Africa to the Europeans, who, however, he says, improved the preparation of it, and first discovered different ways of employing it in war. In no country could

¹¹ In *Opus Majus*, ed. Jebb, p. 474; also in *Epist. de Secretis in Theatrum Chemicum*, v. p. 951, and v. p. 962.

¹² In the year 1798, *M. Langles* proved, in a paper which was read before the French National Institute, that the Arabians obtained a knowledge of gunpowder from the Indians, who had been acquainted with it from the earliest periods. The use of it in war, is said to have been forbidden them in their sacred books, *Veideest* or *Veda*. It was employed in 690 at a battle near *Mecca*, by the Arabians.

saltpetre, and its various uses be more easily discovered than in India; where the soil is so rich in nitrous particles, that nothing is necessary but lixiviation to obtain saltpetre; and where this substance is so abundant, that almost all the gunpowder used in the different wars, with which European sovereigns, except the Russian, have tormented themselves, and cursed the world from its invention,—has been made from Indian saltpetre.

Should not saltpetre have been known in Europe before the thirteenth century, neither could gunpowder or aquafortis have existed before that period; and for the best of reasons, that neither can be made without saltpetre or nitre. But should the truth appear that this neutral salt was known in India, long anterior to that period, and used by Indians as well as Arabians before they were employed by Europeans, and considering the former to have practised chymistry previous to the latter. Should this have been proved, perhaps a similar proof will necessarily await upon the articles aquafortis and gunpowder. Because, should that predicate be established, this will be the inference, then it will be discovered that Europeans knew nothing of aquafortis until after the Arabian chymists. It appears, that no chymical writer, or natural philosopher, has spoken of that caustic before *Galen*; it being thought that those works, of which we have Latin translations, were the productions of the persons whose name they import, as existing in the eighth or ninth century.

Although probability appears to favour this idea, that at, or about the twelfth century, the accumulated number of consequents, from the improvement in European science, the arts we now possess, were introduced into the European catalogue, *i. e.* nitre, aquafortis, and gunpowder.

As the period of the existence of Synesius does not appear to be ascertained, who was an eminent Greek chymist, or perhaps alchymist, because he mentions among chymical solvents, *water of saltpetre*; we cannot have any other idea of this than *aquafortis*; but as he also mentions *aquafæcis*, he would seem, it is thought, to allude by the last expression, to the *nitrum* of the ancients, or perhaps to strong alkaline lees, which can dissolve many bodies.

The monk Theophilus, who, perhaps, lived in the twelfth century, was also acquainted with *aquafortis*. In some of his passages, quoted by Raspe, in his *Treatise on Oil Painting*, published in London, 1781, 4to. p. 145, he speaks of an acid which dissolved all metals. In the writings of Vincent Bellovacensis, in the thirteenth century, traces,

but perhaps doubtful, may be discovered of the notice taken of *aqua fortis*. Where he mentions the different sorts of gold, he speaks of dissolving it, but not alluding to the agency of fire, of which he has previously spoken. Somewhere else, he also speaks of solvents; among them, various vegetable acids, naming a water of sal ammoniac, and a water obtained from alum by distillation: that he here must mean a mineral acid, appears obvious.

Michael Meier, the most learned chymist of the seventeenth century, says, that *Vincentius* speaks of *aqua fortis* as a secret.

Spielman states, that *Lullius*, who died in 1315, in the 80th year of his age, gave an account of his obtaining *aqua fortis* from saltpetre, by the addition of vitriol; and that *Basilus Valentin* was acquainted with clay for the same purpose. *Picus Mirandula*, however, declares it to be uncertain whether *Arnoldus de Villa Nova* was acquainted with the acid of saltpetre in the fourteenth century.

It is an old tradition, that this acid was first employed at Venice by some Germans, for separating the noble metals, and from thence conveyed as an article of commerce to every part of Europe. The persons employed were narrowly watched, to prevent publicity of the practice. They were employed chiefly to separate gold from Spanish silver; by which means they acquired great riches. Hence arose the report in Germany that the Venetians made gold: it appears probable, that in many countries refiners were so regarded. It also appears as a very profitable business, those employed in it generally obtaining great riches. In the fifteenth century it was introduced into France. *William Budé*, born in 1467, died in 1540, speaks of it in a book printed the first time in 1516, as a thing entirely new at that period; whereby it appears that a man of low extraction, named *L. B. Cointé*, first undertook to separate gold and silver at Paris, by means of a water, which *Budé* calls *aqua chrysulca*. It is certainly remarkable, that by means of this water he could separate the smallest particle of gold from silver, and from every other metal; it is even said, he could take from vessels their gilding, without altering their form. By this art he acquired great wealth, which, *Budé* says, were both inherited by his son, who, at the time he wrote, was a gold refiner in Paris.

Although the danger and unhealthiness of the fumes of effervescing liquor are great, the manifest consequences of which have been perhaps magnified, to prevent people from endeavouring to discover the art of refining, it is sufficiently

well attested that the effervescence of saltpetre is extremely prejudicial to health. To avoid this, Le Cointé, after he got rich, entrusted the business to a servant, himself keeping at a distance.

Budé also relates, that by this process, the gold was left behind, entire and undissolved: the silver only was dissolved, and, by another art, was separated from the water and washed. It may hence be seen Le Cointé employed aquafortis. But it is said, if he was able to loosen the gold from vessels without destroying their form, he must have used *aquaregia*, which was then, consequently, not unknown.

It also appears the mint of Paris purchased the secret of Le Cointé, from the son; on which account, Francis I. by a decree, issued at Blois, the 19th of March, 1540, authorised the raising the value of the coin, under the pretence, as it was said, of defraying the expenses of fuel and assaying water. About the middle of the seventeenth century, the preparation of aquafortis, and the process of assaying, were made fully known in France. In the month of January, 1637, the distillers obtained a guild letter, in which *aquafortis* is expressly mentioned as constituting one of the articles in which they dealt. There is also mentioned in the *Almanach des Monnoies*, published 1786, that a Genoese, of the name of Dominic Honeste, obtained permission on the 18th of September, 1403, to maintain an establishment at Paris, for the separation of gold. Although what is called the *wet way* is not mentioned, it is left in favour of conjecture, that the mode by which this operation was performed must have been by ordinary fusion.

After the period that saltpetre became necessary to governments for the manufacture of gunpowder, they endeavoured to obtain it at a cheap rate; and for that purpose were guilty, in some countries, of the most violent and oppressive measures, intruding upon private property of every description to furnish it, hunting for the effervescence in old walls, &c. to the terrible annoyance of individuals. They termed it a *regale*. But, after repeated acts of flagrant oppression from the public officers, and from farmers to whom this iniquitous practice was entrusted, they could not procure a sufficiency, but were obliged to have recourse to traffic in India for that purpose; whence it was brought by return of vessels by way of ballast.

The oldest method of boiling saltpetre, is described by *B. Villafranca*, in a work of his, vol. iii. p. 340, previously quoted.

ARTIFICIAL ICES—COOLING LIQUORS.

Preserving snow, for cooling liquors, in warm countries, appears to have been known in very early ages. The art was known to the Hebrews, believing Solomon.¹ In Greece and ancient Rome, it was quite common, as we have seen in a preceding article on *Feasts*, &c.

There is not, we believe, any specific relation left by the ancients, of the mode of preserving snow or ice through the summer, except the apparently careless expression of Plutarch, on this matter, who says, that a covering of chaff and a coarse cloth is sufficient. Indeed, we are told by *Chares de Mitylenæus*,² that Alexander the Great, when he besieged the city of *Petra*, caused thirty trenches to be dug, and filled with ice; which was covered with oak branches, and kept in that manner a long time. The method recommended by Plutarch, above, is the same which the Portugese, at this day, employ: covering the collected and drifted snow in deep valleys, with green sods; upon the surface they deposit sheep's dung from the fields; this, in the height of summer, they will often carry, on the backs of mules, sixty Spanish miles, to their capital. To a similar mode of preservation to that which Plutarch mentions, St. Augustine is presumed to allude in a before cited question:³ *Quis paleæ dedit vel tam frigidam vim, ut obrutas nives servet; vel tam fervidam ut poma immatura maturat?*

It is said, that when the ancients desired to have cool liquors, they either drank the snow, or put some of it in their wine; not having yet learnt to cool it without weakening the quality. It appears, that their mode of preserving snow by chaff, was objectionable; because, it could not, of course, remain in a perfect state long: they, indeed, discovered that it soon made the snow taste of the chaff, likewise would mix with it, and float upon the top when it was melted; so they were under the necessity of straining the

¹ Prov. chap. xxv. 13.

² *Chares Mitylenæus*, in suis de Alexandro Historiis qua industria nix conservari debeat, exposuit, quo locò *Petræ* urbis Indorum obsidionem enarrat. Scribit enim, Alexandri jussu fossas triginta, parum inter se distantes, excavatas fuisse, easque nive impletas super-injectis quercus ramis (δρυος κλαδους), ac nivem longo sic tempore perdurasse. *Athenæi Deipnos.* iii. p. 124.

³ Vide article *Feasts*, in vol. i.

snow-water before admixture, or straining it after it was mixed, before they could drink it.

Ice was also preserved for similar purposes, as appears from the testimony of various authors, being a practice introduced almost as early as the professed art of cookery, in Greece; indeed, Archbishop Potter, informs us in his *Archæologia Græca*, that public ice houses were established probably in Athens, and that such existed in Rome, is very evident, from the before cited admonition of the moralist.⁴ “That if the Lacedæmonians banished the sellers of ointment, commanding them to leave their city with the utmost speed,—what would have been done, had they seen shops to deposit and preserve ice?”

Although we have no account left us by the ancients of the mode of construction of those repositories, we are certainly warranted in concluding that the principle upon which they were constructed was somewhat similar to our own; namely, to have them of a sufficient depth to exclude the sudden changes of atmospheric air, and indeed of all exterior contingencies of climate, &c. As we have seen that air is the grand medium through which both heat and cold are conveyed to our perception, so it is the soonest affected by change in the general temperature. Without these precautions, it is impossible for the moderns to preserve those substances, and the *semper eadem* of nature tells us, that the same laws now regulate her operations, which were prescribed to them 6000 years ago.

The crown of Sicily derives great profit from the snow and ice carried from *Mount Ætna* to *Palermo*, and other places throughout the year.

The ancients, being, however, men of profound observation, soon discovered the effect, from admixture, of simple natural causes to produce extreme cold, even to congelation and perfect freezing: by means of which they could cool their liquors to any degree, in any state of aerial temperature. This secret, it appears, was known to the philosophers and physicians of ancient Greece, as remote as the days of *Aristotle*,⁵ *Hippocrates*,⁶ and *Galen*.⁷ Pliny has indeed, given the honour to *Nero*,⁸ and says, when they

⁴ Vide Seneca, cited in article *Festivals*, Conf. Athenæus. lib. i.

⁵ Meteorol. i. c. 12 Χρῶνται γὰρ τῷ κρυταλλῷ ὥσπερ τῷ μολυβδαί, ἐν πρεμῶσιν οἱ καλαμοί.

⁶ De Morbis vulgar. lib. vi. 4, p. 274.

⁷ In lib. vi. Hippocrat. De Morbis vulgar. comment. 4, 10. p. 396.

⁸ Hist. Natura, xxxi. 3, 23. p. 552. Neronis principis inventum est, decoquere

wanted water to become cold, it was customary first to place the vessel containing it in the sun, and suffer it to become warm. He also informs us, that those fishermen on the Black Sea, when they wanted the reeds to freeze which they used in fishing, usually poured boiling water on them, being aware they would then freeze the sooner. Galen is still more explicit, who says, that this practice was not so necessary in Greece and Italy, as it was found to be in Egypt and other warmer climates, where was never any snow, ice, or cool springs: for there the water, after it had been boiled, was put into earthen pans and exposed on the top of the house to the night air; in the morning those vessels were put into the earth, perhaps a pit, moistened round with water, and then bound round with fresh or green herbs, or plants; by which means the water was kept cool during the day.

Athenæus also informs us, from *Protagorides*, of the same fact, with the addition that vessels containing water thus heated, were kept moistened with water during the night by servants, whose office it was, and in the morning the vessels were bound round with straw. Also in the island *Cimolus*, water, which had been warmed in the day, was put into earthen jars, and deposited in a cool cellar, where it grew as cold as snow. The ancients, from what we have stated, therefore, believed the fact, that water which had been boiled and left to cool, acquired, thereby, a greater degree of refrigeration;⁹ whence we may rationally conclude, *boiled water* so often occurs in the works of the ancients. This opinion, we understand, is prevalent in Southern Asia at this moment, because the practice is still followed.¹⁰

The experiments, however, which have been made to ascertain the cause of this effect, are innumerable; and the opinions of the ingenious as to the result, are almost as numerous: for sometimes it appears, that water not yet cool, and unboiled water, have been exposed to a frosty air, with an immense difference in the temperature of the two liquids, the effect could not be what had been calculated upon; the operators were deceived. The most rational opinion, however, as to the cause, appears to have been

aquam, vitroque demissam in nives refrigerare. Ita voluptas frigoris contingit sine vitis nivis. Omnem utique decoctam utiliore esse convenit; item calefactam magis refrigerari, subtilissimo invento.

⁹ Alexand. Aphrōdisiensis Quæst. Natura, i. 51.

¹⁰ Traité du Mouvement des Eaux.

given by the ingenious Dr. Black of Edinburgh; because, we think, he is warranted in his conjectures by nature. We afford our readers an opportunity to judge for themselves, by giving the words as we have seen them.

“Boiled water,” he says, “becomes ice sooner than unboiled, if the latter be left at perfect rest.” We have seen already, in the article *Freezing*, the effect of motion in that operation: “but if the latter be stirred sometimes with a chocolate stick, it is converted into ice as soon as the former; which may be ascribed to the following cause: some motion promotes congealation, this arises in the boiled water, through its re-imbibing the air,” in the room of that, we suppose, which was *previously evaporated in boiling*; “therefore it must necessarily freeze before the unboiled, provided the latter be kept at perfect rest.”

*Fahrenheit*¹¹ had previously remarked, that water, at perfect rest, would show a cold some degrees below the freezing point, without becoming ice.

Cavallo has informed us, that he saw, in summer, Fahrenheit's thermometer standing at 64°, fall in two minutes, by means of æther to + 3, i. e. to 29° below the the freezing point.¹²

At Calcutta, Mysore, Pondicherry, and other parts of India, where natural ice never appears, we are informed they have a mode to procure artificial, by the following means: trenches, two foot deep, are dug in an open plain, strewn with dry straw; in these are placed earthen pans, unglazed and shallow, filled with water at sun-set. The ice produced in these vessels in the night, is removed the next morning before sun-rise, then conveyed to a cellar, fifteen feet deep, carefully covered with straw, to prevent the admission of atmospheric air. It is remarked that a great deal in this process depends on the state of the atmosphere. When calm, pure, and serene, it is most favourable to the process of congealation; but when the winds are variable, weather heavy and cloudy, no ice can be procured.

It should appear, that much of the effect of artificial crystalization depends on the nature of the vessel in which the water is contained. It should be unglazed, and not too hard baked, besides, it ought to be perfectly new; which precautions are meant to ensure its being sufficiently porous to admit of the water oozing through it, by which its exterior appears always moist. Unglazed pans

¹¹ Phil. Trans. vol. lxxv. part i. 124.

¹² Ibid. vol. lxxi. part ii. 511.

render the trouble of keeping them moist, as practised by the ancients, unnecessary. This mode, we are informed by Norden, is still practised in Egypt; where it also appears, from him, the art of glazing has not yet arrived.¹³

Plutarch mentions a mode of cooling water, which we have not yet noticed. It consisted in throwing small pebbles or plates of lead into the water; as an authority he refers to Aristotle. The evident intention of this must have been from the motion occasioned in the water by the falling body; also, from the admission of fresh air by the means of the falling substance.

It also appears, from what is related by *Bellon*, that till as late as 1553, the practice of cooling liquors at the tables of great personages, was confined to Italy, and the Italian states alone. In the middle of the sixteenth century, there were no cellars for the reception of ice in France. He likewise recounts how snow and ice are preserved through the year at *Constantinople*, for the purpose of cooling *sherbet*; and suggests that the same means might be adopted by his own countrymen, because he found ice-cellars in warmer countries than in France. At the time of the conference held between Pope Paul III. the Emperor Charles V. and the French King, Francis I. at Nice, *Champier*, the physician to the last named monarch, saw the Italians and Spaniard mix snow with their wines, which they caused to be brought from the neighbouring mountains, to cool them. In order to show he was a stranger to it, and consequently that it could not then have been known at the French court, he pronounced that practice to be *unhealthy*.

Donna Agnes Beatrix Pacheco, one of the ladies of the court of Francis I. having observed the Dauphin to be very partial to water, at table, to improve it, sent to Portugal for some earthen vessels, which would render the water cooler and more healthy; and from which vessels, all the water used at the Portugese court was drunk. It appears, from remains of these vessels, which are still said to be used there, that they are made of *red bole*, unglazed, yet smooth, having somewhat the appearance of Etruscan vases; so little burnt, that they may be easily broken by the teeth: what appears strange, is, that it is said the bits will readily dissolve in the mouth. Now, if water be placed in these vessels, it easily oozes through them, so that when

¹³ Nordens Reise durch Egypten, Breslaw and Leipz. 1779, 8vo. p. 121.

put into the least motion, air bubbles arise; the water which has stood in them acquires a flavour many consider agreeable, perhaps from the nature of the clay of which they are formed, or, it has been said, from the materials with which they are dried. The clay of which these vessels are made, is found at Estremos, in the province of Alentejo; which is that earth the ladies of Spain and Portugal use to chew in their mouths, though much to the prejudice of their health. Their confessors, we are assured, by way of penance, often enjoin abstinence from chewing this earth.

However, by the end of the sixteenth century, in the reign of Henry III. there were snow and ices used quite common in the court of that King. Popular opinion, however, condemned it as the extreme of effeminacy and luxury. During the latter period of this reign, a witty and severe satire appeared, under a fictitious name, intituled, *L'Isle des Hermaphrodites*, a work of much merit, but now very scarce, severely lashing the prevailing follies at the court of the day, similar to that of *Petronius Arbiter*, the master of *Nero's* revels, whence some called him *Nequitia Arbiter*: he wrote the life of that prince under the feigned names of whores and catamites, but his language is of the purest kind, and an excellent model of Roman composition; whence, contrasting the purity of his tongue, with the filth of his subject, he has obtained the pronomen of *Purissima impuritatis Auctorem*. In *L'Isle des Hermaphrodites*, it appears an order was issued that large quantities of ice and snow should be collected, and every where deposited, that people might have an opportunity to cool their liquors; even though it might occasion extraordinary maladies. In the description of a royal entertainment, we are told that snow and ice were placed before the King, and that he occasionally threw some of it into his wine;¹⁴ a practice followed till after the commencement of the seventeenth century,

Towards the close of that century, luxurious modes of living were common in France, at which time, there were many who dealt largely in snow and ice, which was so much in request, that at length government took it into its own

¹⁴ We are also informed from the preface, that the work was first published in 1605; and in addition to the preceding particulars, that upon its publication,—“The French monarch, Henry IV. showed a praiseworthy magnanimity, by not suffering the publisher to be prosecuted; observing, that although the author had taken great liberties, in his writings, yet he had written nothing but what was true.”

hands, and monopolized the trade, by farming it out. These farmers raised the price from time to time; but at length their parsimony, and the prodigal extravagance of the court required such large supplies of each to support it, that the people generally disused it; which caused so great a fluctuation in the value of the article, that government again rendered the trade free: the expense again became moderate, except after mild winters and in exceeding warm summers.¹⁵

The utility of tenacious salts had not, as yet, been discovered to cool liquors; but it has since been found that *saltpetre* mixed in a certain proportion with water, can produce the same effects as an admixture of either snow or ice. It is not now questioned, but it is a property common to other salts, as well as *saltpetre*, to produce this effect. This valuable discovery was made in the beginning of the sixteenth century.

B. Villafranca, a Spanish physician, resident in Rome, about 1550, was retained by numerous of the nobility and great people of that capital; he informs us, that about, and before that period, wines cooled by this means were drank at the tables of all the great, in that voluptuous city. Also observing, he was the first who had made the fact public; which, he notices, was originally occasioned by having perceived that salt water in summer was much colder than fresh water. According to his directions, illustrated by a figure, the liquor must be put into a globular vessel, or bottle, with a long neck, for the sake of holding, and for the motion necessary to be produced; then water must be put into a larger vessel, and the long necked bottle held in the water, whilst *saltpetre* is thrown into the outer vessel; the former must then be put in strong motion, moving it round upon its axis whilst the salt is dissolving. *Villafranca* thinks the weight of the *saltpetre* necessary for the operation, should be equal to one fourth or fifth part of the weight of water employed, which will all crystalize, and may be employed several times in the same manner; the mode he proposes to explain upon the principles of *Aristotle*, and affords his noble patrons directions how to use it, and so preserve their health.

An Appulian physician also, *Marcus Antonius Zimara*, likewise speaks of it in his book of Problems, often published with those of *Aristotle*. The problem of *Zimara*, alluded to, runs thus: *Problema 102. Quasivit dominatio vestra (Joannes Castriota Ferrandinæ dux) propter quod*

¹⁵ Dict. de Com. article *Glacé*.

vinum positum in vase constituto in aqua salinitro commista maxime refrigescit. As this Zimara is found among the Paduan professors as *Explicator philosophiæ ordinariæ*, in 1525, it is probable Villafranca's discovery, published in 1550, was not his own invention: therefore, the honour is due to Zimara.

The name of the person who first thought of the mixture of saltpetre with snow, is not with certainty ascertained; but that compound is known to increase the cold so much, that a vessel filled with water and placed in it, is shortly congealed into solid ice. The earliest account of it appears to come from *Latinus Tancredus*, a Neapolitan professor, in his book *De fame et siti*, published in 1607; who tells us, this experiment should be made with the glass in quick motion; which is analogous to Zimara's discovery.

A. D. 1626, was published at Venice, in folio, the celebrated commentary of *Avicenna*, by *Sanct. Sanctorius*, who relates, that he had, in the presence of numerous spectators, converted a glass of wine into pure ice, by a mixture of common salt with snow. When the salt was equal to one third part of the snow, the cold was equal to three times that produced by snow alone.

Our very eminent and philosophic Lord Bacon, who died in the year last mentioned, also speaks of producing so great a degree of cold, by a mixture of saltpetre with ice or snow, as to cause water to freeze, and that common salt, meaning rock-salt, will have the same effect. He concludes the observation, with saying, that "In warm countries, where snow could not be procured, people made ice with saltpetre alone;" but confesses he never tried the experiment.

The Honourable Mr. Boyle, who died in 1691, went farther than Lord Bacon, for he made experiments with various kinds of salts; he also describes in his *History of Cold*, printed in London, 1774, vol. ii. how a piece of ice may, by means of salt, be frozen to another solid body.

In the commencement of the seventeenth century, confectionary received great improvements from the introduction of well-tasted juices being served up to table in a congealed state. The practice was first common in Paris; by degrees it entered into Germany and other European states. The first author who appears to have noticed it, was *Barclay*, in his *Romance of Argenis*, published in Paris, 1621, wherein he mentions circumstances which do not leave a doubt upon the mind that it had been known there some time: "*Arsidas* discovers, in the midst of summer, at

the table of *Juba*, fresh apples, with one half incrustated with ice; also, a bason made with ice was handed to him, and he was informed, that to prepare all these things was a new art. Snow was likewise preserved all the year through, in pits sunk deep and lined with straw." &c.

The next improvement in a luxurious mode of living, was made by the Italians, by the introduction of an article called *liquori*, by the French *liqueurs*, generally a preparation in which brandy is a basis, rendered of various flavours; made weaker and more pleasant by a numerous variety of mixtures; calculated to please the great, and intended to be removed from the populace by the respectability of its price; subsequent to the marriage of Henry II. while Duke of Orleans, with Catharine de Medici, A.D. 1533, a circumstance which brought a large number of Italians into France, who taught the French how to prepare their delicacies. About the year 1632, the beverage called *lemonade*, was first introduced into the French capital; a liquid of which the chief component is the juice expressed from oranges and lemons, which soon became a favourite liquor, and was prescribed by physicians to patients in fevers, and highly recommended against putrid diseases.

Procope Couteaux, an Italian from Florence, about 1660, first converted this liquor into ice. The ready sale he found for his invention, induced a number of competitors to follow his example. It is conjectured, that the chief article sold by *limonadiers* about the year 1676, was then cooled or changed liquor. The patent they received upon it, at this time, runs thus: *Eaux de gelée et glaces de fruits et de fleurs, d'anis et de canelle, franchipanne, d'aigre de cetre, du sorbec*, &c.¹⁶ In Paris, there were then 250 masters employed.

ARTIFICIAL PEARLS.

PEARLS are those globular calcareous excrescences found in the interior and exterior of certain shell-fish, chiefly upon a species of oyster, and under the shield of the sea-hare, (*aplysia*,) as has been observed by *Bohadsch*, in *De Animalibus Marinis*. *Dresden*, 1761, p. 39.

From the earliest ages of the world, there is room to

¹⁶ De la Mare, *Traité de la Police*, iii. p. 799.

suppose, from certain passages in *Job* and the works of *Solomon*, they have attracted the admiration of mankind, and been highly appreciated; hence as ornaments, they had, perhaps, an extravagant value set upon them by humanity. This worth, however, must be considered merely nominal, because their scarcity has been found to determine their relative value, and to enhance it in the estimation of our species.

Some few Grecian and many Roman authors bear testimony of the value which the Roman ladies set upon this article of female ornament, and they also give evidence of the prodigality of *Cleopatra*, who, according to her biographer, at a feast which she gave to *Antony*, dissolved one of a pair of pearls of the value of £50,000 sterling, and drank the solvent before him, to show how little she valued those things which were considered inestimable by others. Also certain of the Roman emperors, as *Clodius*, we are told, on one occasion gave each of his guests a valuable pearl, dissolved in a glass of acid, to drink, on which transaction *Pliny* thus expresseth himself: *Ut experiretur in gloria palati, quid saperent MARGARITÆ; atque ut mire placuere, ne solus hoc sciret, singulos UNIONES convivis absorbendos dedit.* Horace, lib. ii. sat. 3, speaks to the same effect: and *Caligula* says, *MARGARITAS pretiosissimas aceto liquefactas sorbebat.*

The cause which is conjectured to have rendered pearls so very valuable, independent of those reasons which have been assigned, was on account of their being so readily associated with articles of ornament, being usually set in, or attached to gold, to which, at the time they afforded an agreeable relief from the delicate contrast of their elegant colour, the effect of association affords a most agreeable lustre, and contributes in a superior degree to ornament a fine skin or a delicate colour. The evidence of every one's observation will support us in ascribing great and uncommon powers to this article of ornament when exhibited in the concentrated reflection of lamp or candle-light, the usual illumination at the times for fashionable assemblage among the ancients, as well as adopted by the moderns.

So emulous were the ladies of ancient Rome of ornamenting themselves in the richest manner, that pearls of the largest price were in great request. This might, very probably, have given origin to the idea of endeavouring to procure ARTIFICIAL ones. At first, to effect this, the ancients had recourse to the source whence they were originally produced, which occasioned many ingenious devices

to procure them, with the assistance of those creatures who produced them in the first instance. Whence, it is said, the Ethiopians on the coast of the Red Sea, have from time immemorial been in the habit of procuring pearls by unnatural means from the shell-fish in that sea. The mode by which they obtained them is thus related by *Apollo-nius*. They dived into the sea, after they had rendered it calm, and, it is said, perhaps clearer, by throwing oil into it. They then enticed the fish by some bait to open the shell; and having pierced it with a sharp instrument, it emitted a liquid they carefully caught in an iron vessel, in which the drops so procured hardened into pearls. Lest there should be certain parts of this relation which have not our readers credence, we subjoin below the original Latin, from whence the English translation is made.¹

Olearius says, this account is to be found in no other author; but as *Tzetzes* has copied it, his words may, perhaps, afford an illustration.²

The whole of the nations of the Oriental world are remarkable for bringing to perfection the most difficult of arts, which they effect, as did their progenitors, in consequence of religiously observing the direction of their predecessors, and also in consequence of the children being brought up to, and following the same business which their fathers had pursued before them: by these means historians have repeatedly observed the inhabitants attain a perfection to which the western world are strangers, and which is often the cause for exciting our

¹ Dignum existimavi quæ de altero margaritarum genere (arte facto scilicet) traduntur non prætermittere, quandoquidem nec ipsi Apollonio res visa est levis, sed auditu jucunda, et mirabilium omnium mirabilissima. Nam, qua parte insula pelagus respicit, immensa est maris altitudo; fert autem ostreum in testa alba, quadam pinguedine referta. Lapidem autem nullum producit. Inde maris tranquillitatem observant, et aquæ superficiem etiam ipsi olei infusione levigant. Tum ad ostrea capienda ingreditur aliquis, ita instructus paratusque sicut qui spon-gias colligunt. Est autem ei ferreus later (πλινθίς σιδηρᾶ) et alabastrum unguenti; atque ita prope ostrea considens Indus unguento quasi esca ad fallendum utitur. Namque illo perfusa ostrea sese aperientia inebriantur. Tunc ferreo stylo (κέντρον) perforata quasi saniem quandam emittunt. Hanc venator ferreo latere (πλινθίδι) excipit, qui in varias multiplicesque formas concavatus est. Ea vero postmodum sanies lapidescit, atque in modum naturalis margaritæ albus ille sanguis obdurescit. Et hæc est quæ ex Rubro Mari colligitur margarita. Huic autem venationis generi etiam Arabes intendunt, ex opposito maris habitantes.—*Philostrat. in Vita Apollon. lib. iii. cap. 57.*

² Uniones alios τυπωτους, alios χειροποιητους vocant. Priores sic fiunt: ingreditur aliquis (mare) cum veru et typario (instrumento aut vasculo) ferreo, idoneo ad speciem rotundam margaritis conciliandam. Hoc proxime concham posito, ostreum (carnem animantis) veru pungit; fluit e vulnere sanies, quæ vasculi formulis excepta densataque margarita fit. *Tzetzes variorum, lib. ii. segm. 373.*

wonder. Whence it may be probable the Ethiopians, Indians, Chinese, and other oriental countries, famous for arts and industry, may have attained a perfection in the pearl fishery to which we are strangers, therefore their practices have not general belief; but as the reasons submitted may claim a portion of reflection, we should meditate a little before we conclude upon our final opinion of the unimpeached claim of those authors to historical truth; nor suffer any influence on our minds to traduce such their authority, but let them have the benefit of our dispassionate hesitation.

We may not be sufficiently acquainted with the art of conchology to judge upon every occasion what may be facts or falsities; and, perhaps, in the question now agitated, we are comparatively ignorant; how can we then presume to impeach the veracity of authorities which has stood the critical test of ages, without we have the power from unquestionable facts to controvert their assertions?

The present Chinese are said to have a mode to procure by *horti-marinal* and *exotic* means, (being allowed the expression,) a species of pearls from a kind of muscles, and the means they use to attain them approaches near to the mode recited by *Philostratus*. It is thus: in the beginning of summer, at the time when the muscles arise to the surface of the water, and occasionally open their shells, they watch the moment, and place in each shell five or six small beads of mother-of-pearl, or, it is said, occasionally of some other substance, as we shall see presently, strung upon a thread; at the end of the year when they fish for these, they draw them up, and upon opening of them discover the beads or other particles, incrustated with a pearly substance, in this manner they have the perfect resemblance of real pearls. Indeed, it is said, that there is at this moment in the possession of the venerable President of our Royal Society, large *chamæ*, brought from China, which are a species of muscle, in which there are several bits of iron wire incrustated with a pearly substance. Those bits of wire, it appears, were originally rough, and it is judged probable the animal emitted this substance as a mean to procure ease from the irritation it must unavoidably occasion.

The parent of natural history and immortal systematic regulator of classical arrangement, the great LINNÆUS, also introduced a design, which, perhaps, may not be considered as a *new* invention, of which he informed his sovereign and council in 1761, that he had discovered an art, by which muscles might be made to produce pearls, and he offered to disclose the method for the benefit of the kingdom. This,

it appears, was not, however, done; but, it is said, he afterwards disposed of it to one *Bagge*, a Gottenburg merchant, for the sum of 18,000 copper dollars, about 500 ducats. We never have heard of this being acted upon; indeed the heirs of the merchant have since been desirous of disposing of this secret, and accordingly, in 1780, it was put up to sale in a sealed *recipe*; but whether the paper was purchased, or who bought it, we are not informed. *Linnæus* was afterwards ennobled by the title of VON LINNE. It has been by some conjectured that it was in consequence of this discovery; but we have the power to contradict that; for recollecting in his life the circumstance mentioned which led to this advancement. His biographer informs us, that the King of Spain, having then recently given him a courteous invitation, with an offer of nobility, which the patriotic *Linnæus* as handsomely declined, at the same time observing, “If he had any merit, he considered it was due to, as being the property of his native country.” This is the sentiment, but we will not vouch for the correctness of the words, as we have not now recourse to the authority, assigned by his biographer for his being advanced to the nobility of Sweden. If, indeed, any other thing than his own intrinsic merit could have given him elevation among the sons of men; whose genius had exalted him as far above the mediocrity of common nobility, as is the distance between the heavens and earth!

There is also a spurious kind of pearl formed sometimes by the following means. The shells of certain fish are bored with an instrument to the size the pearls are desired of; the animal, in order to repair its covering, has the power to emit a substance, which is of a pearly nature, into the interstice to fill the vacuum. But this mode is not always successful, and the defect is presumed to arise from the avarice of the operator, who being desirous of large pearls, generally has been said to make too large an orifice, or else they pierced the shell too deep, or, perhaps, not a sufficient depth: besides they may have made choice of an improper season.³

It appears, the great objection to those pearls so produced is, that they are not, indeed they cannot, be considered as proper pearls, for the genuine and most beautiful

³ It is presumed this was not the mode employed by *Linnæus*; although he has a passage in his *Systema Naturæ*, which may induce a suspicion, where he says, *Margarita: testæ excrescentia latere interiore dum exterius latus perforatur.* Dr. J. E. Smith, of London, is said now to possess the *recipe* of *Linnæus* for this purpose.

of these calcareous productions is that which is found in the inside of the shell, whence that saying of Pliny, *Quo apparet, nos uno conchæ genera nasci*.

From the transactions of the Swedish Academy, it appears to be an opinion entertained by *M. Lister*, that the growth of pearls might be considerably promoted by impregnating the water, where the fish which produce pearls are bred, with calcareous matter for nourishment; but, we understand, the younger Linnæus gave his opinion that his father's plan favoured of neither of these projected designs.

Under the appellation of artificial pearls, come those small semi-transparent beads prepared by art so near to imitate the form, colour, and lustre of real pearls, that they assume this name. It should appear, however, from the silence of the ancients, and particularly *Pliny* on this subject, that in his time it was not known; therefore this inference furnishes us with a conclusion that this art is of modern invention.

Numerous modes have been resorted unto by the ingenious to procure this imitation. At first it was conjectured, that it was possible to manufacture large pearls from a number of small or broken ones. *Tzetzes* speaks of this imagined art in the following terms. *Arte autem sic parant: e parvis margaritis comminutis alias majores in orbem effingunt*. But all endeavours to effect this have failed; because art wanted the assistance of that menstruum which nature can alone supply,—that connecting medium which nature yet conceals and keeps to herself.

The idea of manufacturing globules of glass, covering them with a substance resembling the appearance of pearls, which art could supply, appears more congenial and co-relative with the purposes of human ingenuity, whose theatre of action must be confined to an imitation of those appearances we observe in nature. The nearer it can approximate to the reality, the more perfect is the art. But the last mentioned mode was discovered soon to fail; because it was found that such semblance, although at first it appeared to approach very near to the original, yet when it was brought into the influence of heat, the beautiful pearly gloss was dissolved, which must have been the case, of necessity, to almost every kind of varnish in certain degrees of heat.

The next idea was certainly better calculated to answer the purpose; although found on experience not entirely to obviate the last mentioned difficulty. A French bead-maker, of the name of *Jaquin*, at length found out a method

of preparing glass beads, like those at present used, approaching as near to nature as possible; for the first idea of which he was indebted to the following circumstance. He observed, when once at his country retirement near *Passy*, that water wherein those small fish they call *ables*, or *ablettes*,⁴ were washed was covered with fine silver-coloured particles. Suffering this water to remain, and the sediment to settle, he obtained from it a most beautiful powder, which had every lustre of the pearl. He also scraped off the scales of the fish, and by this means procured more, and called the white shining powder he procured therefrom, *essence d'orient*, thereby intimating his intention to have it understood to be of oriental pearls. At first he made small beads of paste, or gypsum, which hardened by drying; then he covered them with this powder by gums or some adhesive substance. This invention being *new* in France, he procured an extensive sale for them: but the ladies, for whose use they were intended, soon discovered their inutility; for the material with which the pearly crustation had been fastened, like that mentioned in the last invention, could not resist the influence of animal heat, but separated from the substance beneath it, leaving its shining crust upon the skin of the fair. And although they were much accustomed to the use of pictural decoration, this was a substance which in every place was not considered applicable. It accordingly fell into merited contempt and general disuse. However, the ladies who had been so disappointed, *themselves suggested* to the artisan a better method, which was the same or nearly that which is at present practised. They advised him to prepare some *glass* globules, and to coat the inside with his oriental essence; which suggestion he followed, and it was the means of bringing to perfection the art; a general idea of which may be collected from the following relation. A kind of glass, easy to melt, of a blue tint, is prepared in long slender tubes, called in France *girasols*, a word implying *opal*, and is what is commonly understood here by the name of cat's-eyes, in appearance of a semi-transparency. From these the artist blows, with the assistance of a lamp alone, as many globules as he has an occasion for: one workman can furnish 6000 per day, but if required extremely beautiful, he must be content with half that number. In pearls thus constructed, it is usual for the maker to give some of them the appearance of occasional blemishes, that they may the nearer re-

⁴ The English name for this fish is *bleak*.

semble nature. They are made occasionally of all figures, sometimes nearly circular, often elliptical, sometimes between both, and frequently like a pear or an olive. Some are constructed as *coques de perles*,⁵ i. e. flat on one side and globular on the other, in imitation of those beautiful shells the French call *perles coques*, or *les coques de perl*, a produce of the East Indies, and described by *Pouget* in his *Traité des Pierres precieuses et de la Manière de les employer en parure*. Paris, 1762, 2 vol. 4to. i. p. 20, which he thus describes: “ *La coque de perle* is not formed in a pearl shell
 “ like the pearl; it is procured from a kind of snail found
 “ in the East Indies. There are several species of them.
 “ The shell of this animal is sawn in two, and one *coque*
 “ only can be obtained from each. The *coques* are very
 “ small, and one is obliged to fill them with tears of gum
 “ mastic to give them a body before they can be employed.
 “ This beautiful snail is found sometimes in the sea, but
 “ generally on the shore.”

To return to the article pearls. To overlay, or rather cover the interior with the necessary material to give the proper colour, the artist mixes the pearl essence with melted isinglass; the more of the former he uses the more beautiful does the pearl become, consequently the more valuable. This varnish when heated he blows into it through a small tube, placing them in a sieve, or some such vessel, which he has over his table, and which he puts in motion with his feet, till the whole of the inside be completely covered; he then fills them with white wax, to give a consistency: they are then bored, and strung on skeins of silk, taking care to secure the passage through them with fine paper, that it may not adhere to the wax.

The first makers of these pearls must in the beginning have laboured under manifest inconvenience, from their not being able to preserve the powder they employed, as it soon becomes putrid, and is only beautiful whilst used fresh: to preserve it, they resorted to brandy and other strong spirits, but these were found inexpedient; they now preserve these animal particles by keeping them in *volatile alkali*.

The trade of manufacturing them has been ever since, we believe, confined to France. At St. *John de Maizel*, or *Mezel*, in the *Chalonnais*, there are upwards of 10,000 pearls manufactured daily.

⁵ By Pliny they were called *physemata*; artificial pearls of this kind have heretofore been used for ear-rings. Irregular pearls are called *baroques*, from there being many collected and brought from *Perth*. Some years since large artificial pearls of an unnatural size, and called *Scotch pearls*, were in fashion.

ARTIFICIAL RUBIES AND COLOURED GLASS.

The manufacture of glass we find was quite common in Ethiopia, Syria, Assyria, and other eastern districts, in the very earliest ages of the world, as Diodorus Siculus informs us, who saith, the Ethiopians enclosed in glass the bodies of their parents and friends; but as we have seen in a former article, that in this respect the historian was deceived, and having bestowed some time in discussing that subject, a repetition of our observations would be here superfluous. But it really appears probable, that soon after the art of making glass was discovered, the idea of communicating to it some colour would easily present itself; this probability appears increased, when it is recollected that much care is requisite to render glass perfectly colourless. As the various metallic particles with which stone and sand abound, (these being the chief ingredients of which glass is composed, and which generally give tints in fusion,) will almost unavoidably communicate some hue or other; therefore the perfection of glass is to have it perfectly colourless.¹

But with respect to coloured glass, so frequently have people been imposed upon by having coloured glass sold to them for valuable stones, that some conscientious authors have very laudably and carefully abstained from lending the benefit of instruction in its manufacture.

An anecdote is related by *Trebellius Pollio*, of a whimsical kind of punishment inflicted upon an impostor by *Gallienus*, for having sold his wife a piece of glass for a valuable jewel.²

The Egyptian artists were so famous in the manufacture of glass, that the Romans were content to receive this article from the glass-houses in *Alexandria*, and did not interfere in endeavouring to procure the art themselves, until the latter period of the empire.

We read that an Egyptian priest made a present to the Emperor Adrian of several beautiful glass cups, which sparkled with many colours, and such value did that august personage place upon these toys, that he directed them to be used only on high feasts and solemnities.

¹ Maximus tamen honos in candido translucentibus, quam proxima crystalli similitudine. *Plin.* lib. xxxvi. c. 26.

² *Historiæ Augustæ Scriptores*, in vita Gallieni, cap. 12.

Strabo relates that a glass manufacturer of *Alexandria*, informed him, that an earth was found in Egypt, without which the valuable coloured glass could not be made. The words of this author are, 'Εἶναι τινα καὶ κατ' Αἴγυπτον ὑαλίτιν γῆν, ἧς χωρὶς οὐχ οἷόν τε τὰς πολυχρόνους καὶ πολυτελεῖς κατασκευὰς ἀποτελεσθῆναι. *Strabo. Amstelod. apud Wolters, 1707, fol. lib. xvi. p. 1099.* It has been thought by some, the glass earth here meant was a mineral alkali which was readily found in Egypt, serving to make glass; but this author speaking expressly of coloured glass, it has been suggested as probable, the alkali above named could not have reference to what the artisan intended to imply, but that it must be referred to some metallic earth or manganese.

One Democritus is named by Seneca,³ as having discovered an art of making artificial emeralds; but it has been conjectured that what the philosopher meant, was the art of communicating colour to natural rock crystal or colouring glass already made, so as to resemble stones, which is a process performed by cementation. Directions have been furnished for this purpose by Porta, Neri, and others; but it is discovered, that the articles so coloured are liable to such accidents in the process, that it is next to impossible to render things of any size tolerably perfect, so as to bear cutting afterwards.

In the *Museum Victorium* at *Rome*, there are shown a chrysolite and an emerald, both perfectly well executed and thoroughly transparent without the least blemish.

We have not from the ancients an account of what process they employed; but it must be evident that nothing less than metallic calces could have been used; and for this evident reason, that any other substance could not have resisted the influence of the necessary heat. The last century has, however, produced certain artists in northern European nations, who have adopted a method of employing the precious metals, to communicate a tincture to glass in the process of making, where iron, &c. were originally only used; and their endeavours have been attended with singular success.

By means of amalgam of gold, or a dissolution in *aqua-regia*, and precipitated with a solution of tin, the metal then assuming the appearance of a rich purple coloured powder: so prepared, it is mixed with the best *frit*, and then called the precipitate or gold calx of Cassius, the inventor, gold purple, or mineral purple.

³ Senec. Ep. xc.

This precipitate communicates a rich ruby coloured purple, so perfect that it is impossible to discover the deception, without the substances be tried by the usual means,—cut with a diamond or a prepared file.

We have had in England some very eminent artists within a few years in the practice of staining glass, and also for making artificial representations of various precious stones.

Although the professed object of alchemy has now met with that contempt it merited; because, notwithstanding the immense sums which have been expended, the time lost, and unprofitable trouble employed in the unavailing search after what probably will never be found; yet the labour lost and money expended has not been totally useless, since it has served to open the seals which secured chymical science to the modern world; and which is the chief, if not the sole advantage it can claim over antiquity for superiority of information: notwithstanding we possess to the full, perhaps, the benefit of the KATHMA ΕΙΣ ΑΕΙ of the ancients, with our own experience to assist in our researches, yet we remain far behind their perfection.

Painting on glass, but, perhaps, *staining* had been a more appropriate expression, or properly speaking in enamel, with the preparations for colouring in mosaic work, may to a certain extent be justly considered as branches of the art of colouring glass; in all which there is no colour more difficult to be attained than a beautiful red; it now is, and ever has been most difficult, consequently the dearest colour. The presumed ignorance of ancient artists in preparing this colour, has afforded some reason, it is said, to suppose the ancients knew of no other substance proper for that purpose, but calx of iron or manganese. To this we may reply, many specimens are found which show they were not so ignorant in that art, and that it is more than probable the same jealousy which is found to exist in modern days among artisans, might prevent our sagacious predecessors from publishing the secrets of their respective professions to the world. We contend, that as the materials must then have had existence, which have been since so successfully employed, pray what was the reason the ancients should not avail themselves of their benefit? In all the higher speculations of science and arts, where the great and superior energies of genius were requisite, this perfection in the ancients far surpassed any exertions which have been since achieved by the moderns. To instance one artist and one art solely, we name the immortal PRAXITELES, in the art of *statuary*, whose works were a model of perfection!

BOOK-KEEPING (ITALIAN).

The utility and importance of this art is, it must be confessed, very great to the interest of the mercantile world. It is an art which obtained in its native region the appellation of *Doppia scrittura*, which name with that of several terms used in the art, import that it claims its origin from that country whose name it bears. Its first existence appears to have been in that once great theatre of trade, *Venice*.

The most ancient account we have of it appears in a notice to which *De la Porte* refers, when he says, “About the year 1495, brother *Luke*, an Italian, published a treatise of it in his own language. He is the oldest author I have seen upon the subject.”¹

Anderson, in the first volume of his “*Historical and Chronological Deduction of the Origin of Commerce*,” gives the following account: — “In all probability, this art of double entry of accounts had its rise, or at least its revival, among the mercantile cities of Italy; possibly it might be first known at Venice, about the time that numeral algebra was taught there; from the principles of which science, double entry, or what is called MERCHANTS’ ACCOUNTS, seem to have been deduced. It is said that *Lucas de Burgo*, a friar, was the first who published his algebraic work at Venice, anno 1494.”

This *De Burgo* was one of the greatest mathematicians of the fifteenth century; he is supposed to have acquired his mathematical learning from the writings of the Arabians, though most probably from the Greeks, as the Arabians were not so eminent for learning themselves, as they were famous for preserving what they got from those few books that were saved from the wreck of the Alexandrian library, and the ruin of the Grecian empire, which they had the fortune to subdue: and we knowing this, therefore, are not inclined to give them the full homage on the account of profundity and variety of literary talent which is sometimes ascribed to them. They, as an insulated and primævally simple people, except in their own language, national rhetoric, and poetry, did rather deserve execration, than adulation or just praise, for their ignorant destruction of the finest and

¹ La Science des Négocians et Teneurs de Livres. Paris, 1754. 8vo.

most extensive collection of the labours of the most intellectual and illuminated of the literary sons of fame, in every age of the world. However, this *Lucus Paciolus, e Burgo S. Sepulchri*, was a Franciscan, and surnamed from a town in the duchy of *Urbino*, on the Florentine confines, called *Burgo S. Sepulchro*.

Anderson says he possessed the oldest book published in England, in which an account is given of *double entry*. It was printed in London, in 1569. The name of the author is James Peele, who in his preface says, "He had instructed many in the art, which had been long practised in other countries, though in England it was then quite new."

It is presumed Anderson was apprised of the difference between single and double entry, but he is said to induce nothing to obtain our belief that Peele taught the latter and not the former, for what he has said of debit and credit is also said to be of no importance, and that it is applicable to either method.

There is no mention appears of this Peele in *Ames' Typographical Antiquities*; but that work takes notice of a still older tract, being a treatise on Book-keeping, intituled, "A briefe instruction and manner how to keepe Bookes of Accompts, after the order of debtor and creditor, as well for proper accounts, partible, &c. by three bookes, named the Memorall, Journall, and Leager. Newly augmented and set forth by John Mellis, Schole Maister." London, 1588, 12mo. Mellis himself, in his preface, says, that he is only the re-publisher of this treatise, which was before published in London, in 1543, by a schoolmaster named Hugh Oldcastle. It is conceived that from the above title, and especially from the three books specified, this is a true method of the genuine principles of book-keeping by double entry.

The most ancient German work on book-keeping by double entry, of which we have an account, was written by John Gotlieb, and printed and published at Nuremberg, by Frederick Peypus, in 1531.

The author in his prefatory observations styles himself a citizen of Nuremberg: he says he proposes to give the public a clear and intelligible method of book-keeping, and such as was never before printed. He therefore appeared to consider his book as the first of the kind, we may infer, that was ever printed in Germany.

Financiers, about the end of the sixteenth century, first begun to introduce this mode of accounts into statistical records of receipts and expenditures. In the work of Simon Stevin, published at Leyden in Dutch, and after-

wards, in the same year, in Latin, with a dedication to the Duke of Sully, we find a system of book-keeping drawn up, as it appears, for the use of *Maurice Prince of Orange*. The author apologizes for his dedication to the illustrious foreigner, ascribing as a reason, because the French had paid the greatest attention to improve the method of their statistical and public accounts. The work is in dialogue, and commences with a conversation between the Author and Prince Maurice respecting the application of book-keeping to public and national accounts; in which he explains the principles of mercantile book-keeping. This converse commences with explaining the nature of debit and credit, with the principal accounts. Then succeeds a short journal and ledger, in which the common transactions only occur. The whole concluding with an enumeration and description of the other books necessary for proper mercantile book-keeping, and of the mode of balancing. Stevin expressly says, that Prince Maurice, in the year 1640, caused the public accounts of Holland to be made out after the Italian method, by an experienced book-keeper, with the best success: whether this regulation was continued, and its final result, we are not informed. The mode of this author, in his Latin version, shows much ingenuity. For he supposes three ministers and three different accounts, to whom he ascribes truly ingenious and apparently perfectly applicable names, *i. e.* a *Quæstor*, who receives the revenues of the domains; an *Acceptor*, who receives all other revenues of the prince; and lastly a *Thesaurarius*, who has the care of the expenditure, and to whom the two former pay and account for the various items they have received. All inferior officers are appointed to send from their books monthly extracts, which are to be doubly entered in a principal ledger; so that it may be easily seen at all times, what balance remains in the hands of each respective receiver, and the amount which each has to collect from the debtors. We are told by Bayle the Latin translation was not made by Stevin himself, but that he had procured it to be written by *Willebrord Snellius*. Book-keeping is called *apologistica* or *apologismus*; a book-keeper, *apologista*; the ledger, *codex accepti expensique*; the cash-book, *liber deletitius*; accounts are called *nomina*; stock account, *sors*; profit and loss account, *lucri damnique ratiocinium*, *contentio* or *sortium comparatio*; the final balance, *epilogismus*; the chamber of accounts or exchequer, *logisterium*.

At the end of his work Stevin attempts to prove that the

Grecians, and after them the Romans, were in some sort acquainted with book-keeping; so they doubtless were, and the Greeks in particular, and in fact they could not have done without, being great commercial people; and it is also probable he might have deduced it to a more remote antiquity, by travelling as far retrospectively as *Phœnicia*, and perhaps beyond these still to *Egypt* and *Syria*: for that commercial intercourse was common between all these people may be collected from various of the preceding articles; as a final authority for this assertion, numerous passages in ancient authors could be quoted in support of the position: however, we collect one from the ingenious *L'Abbé Pluche*, in his *Histoire du Ciel*, tome ii. Indeed, by the general consent of ancient history and chronology we cannot be deceived in this; those people, the Phœnicians, were in the habit of being the general trading medium of universal commerce between the early nations of the whole earth. But to return. In the end of this work the author proves the commerce of Greece and Rome, upon general principles, and illustrates them by a quotation from Cicero's Oration for *Roscius*, and likewise from this passage in *Pliny*:—
*“ Fortunæ omnia expensa, huic omnia feruntur accepta, et
 “ in tota ratione mortalium sola utramque paginam facit.”*
 This passage as well as the terms which had been used, *tabulæ accepti et expensi; nomina translata in tabulas*, seem to indicate that the Romans entered debit and credit in their books on two different pages; doubtless, for how could they avoid it: business must of necessity have been transacted upon nearly similar principles to what now regulate commercial transactions. This has, we know, been objected to, because it is said they were not acquainted with Bills of Exchange. This is admitted to the utmost extent; but then we contend that if they were not familiar with those specific papers, to denote their debts, they had others, *Bills of Acceptance*, as may be proved: these were familiar to antiquity, from this passage recorded in the gospel of St. Luke. Ὁ δὲ εἶπεν· Ἐκαλὸν Βάτης ἐλαίς. Καὶ εἶπεν αὐτῷ· Δέξαι οὐ τὸ γράμμα, καὶ καθίσας ταχέως γράψον πενήτηκοντα. — Κεφ. xvi. 6.

BILLS OF EXCHANGE.

As the present question may be said to have relation to the last article, *Book-keeping*; we hope that from the proof we there adduced, we have established, that among commercial nations, accommodations similar in effect, though not in form, to bills of exchange, existed in the

most remote antiquity. The affairs of the *Phœnicians* are assuredly not so well understood in this country as they ought to be, and perhaps the great obstacle to this knowledge arises from our partiality to Roman concerns, who are well known to have inherited an invincible antipathy to the whole *Punic* nation, as well as against their progenitors the *Cœlosyrians*, a people as eminent for public virtue, as they were reported infamous for a want of faith; at least, according to Roman Historians, so that even now, when we hear of a laxity of integrity in any nation, or people, it is common to say it was a *Pœnic* transaction; *Pœnic fear*, and *Pœnic faith*, are common expressions. But so far did the unjust policy of Rome multiply the errors and magnify the mal-transactions of that injured and oppressed people, that the great cause of our ignorance of Carthaginian and Phœnician concerns, will be readily discovered, in reflecting that we have only the *ex parte* relations of the historians of Rome to inform us of the concerns of that people;—and Rome was their declared enemy. From what little we do know, which has unavoidably crept into the narrations of the Romans, and these afford us ample opportunity to admire Carthaginian public virtue.

Our ignorance of the modes of transacting business by the eminent Phœnician merchants, can afford us no proof of the non-existence of bills answering in effect to our bills of exchange; but on the contrary, our slight knowledge of commercial transactions enables us to see the utter impossibility to manage business, on a large scale, without such accommodation. That the Phœnicians were at one period the general medium of commercial intercourse between the whole world, and that their business must necessarily have been large, we have previously, in a former article, shown; and if we admit the truth, that although affairs were not then probably carried on equal to the great extent they now are; for the artificial wants of man were not then so numerous, we have conceded all that can be expected: yet not from the multiplicity of merchandize, but from those articles then required, being necessary to be furnished in large quantities to a great variety of population in numerous districts: it will be admitted, that it must have been impossible for those commercialists to have managed their entire transactions without the aid of some such documents. Although we are well informed that a great portion of the commerce of those days was carried on by *barter* of one commodity for another; but it could not happen, that, upon every occasion, this should be answerable to the views of either first purchasers, retailers, or to those of customers, much less could

it be always presumed to be convenient to the salesman ; and differences in value must have, of necessity, given frequent occasion to have recourse either to money, or to some medium equivalent thereto ; a demand upon the *credit* of the party, certainly appears the only mode to which they could resort : this must have been by bill or acknowledgment,—denominate it by what appellation you please.

We have seen by the chronological tables, before furnished, the period when gold and silver were first introduced in a great commercial nation, that of *Greece*. Before the Trojan war, money was not thought of ; for the armour of the *Homeric* heroes was purchased by barter ; *nine oxen* paid for the arms of *Diomed* ; whilst those he received from *Glaucus* cost 100 beeves ; such were the mutual presents of the generous warriors, as *Mr. Pope* harmoniously informs us :

- “ Thus having said, the gallant chiefs alight,
- “ Their hands they join, their mutual faith they plight ;
- “ Brave *Glaucus* then each narrow thought resign’d,
- “ (Jove warm’d his bosom, and enlarg’d his mind :)
- “ For *Diomed*’s brass arms, of mean device,
- “ For which nine oxen paid, (a vulgar price,)
- “ He gave his own, of gold, divinely wrought,
- “ A hundred beeves the shining purchase bought.

Iliad vi. v. 295, et seq.

If the ancients could not occasionally make up their bargains by barter,—and having little or no money, what were they to do ? We submit, without some accommodating medium it would have been impossible for them to have done what they actually did perform. At least, such is the state of the question, which our own imperfect conception of ancient commerce hath enabled us to make ; with deference is it submitted to the judgment and liberal opinion of those whose superior information may enable them to obtain a clearer view of the subject. With respect to modern concerns of this nature, we suspect we shall be enabled to render a more conclusive detail, because more definite.

The earliest and most satisfactory notice we find of the article which heads this portion of our labours, is of a comparatively recent date, occurring in a work intituled, “ *Memorias historicas sobre la Marina Comercio y Artes de la antigua Ciudad de Barcelona, por D. Antonio de Capmany y de Montpalau,*” Madrid 1779. 2 vol. 4to. It is a history, written in Spanish, of the maritime commerce of Barcelona, extracted entirely from the archives of that city, and accompanied with documents from the same source, which abound with highly interesting in-

telligence. Among the latter, is an ordinance issued by the city of *Barcelona*, A.D. 1394, that bills of exchange should be accepted within twenty-four hours after they were presented; and that the acceptance should be written on the *back* of the bill.¹

In the year 1404, the magistrates of *Bruges*, in Flanders, requested those of *Barcelona* to inform them what was the common practice, in regard to bills of exchange, when the person who presented, (possessed we presume,) a bill of exchange raised money upon it in an unusual manner, in the case of its not being paid, and by these means increased the expenses so much, that the drawer would not consent to sustain the loss; an equivalent, perhaps, to our modern accommodation bills. The bill which gave occasion to this question, is inserted in the memorial; and is written in the short form still used: which certainly implies its antiquity. It also speaks of *usance*; and by it, it should seem that at that time first and second bills were drawn, and that when bills were not accepted, it was usual to protest them.

In this historical narration of mercantile transactions, among other things, is a custom-house *tariff*, written in Latin of the year 1221, in which occur a great number of remarkable names and articles which are unexplained. Another of the same kind of 1252. Letters of power to appoint consuls in different countries, as *Egypt*, *Syria*, &c. dated in the years 1266 and 1321. An ordinance of the year 1458, respecting insurance, which required that *underwriting* should be done in the presence of a *notary*, and declared *polices o scriptures privades* to be null and void. A *privilegium* of the Emperor *Andronicus the Second*, to the merchants of *Barcelona*, written in Greek and Spanish, in 1290. An account of the oldest Spanish trade in wool, silk, salt, and saffron; and of the oldest *guilds*, or incorporated societies, in *Barcelona*, &c.

In the case of neither the first or second bills being accepted, upon presentation of the protest, because, perhaps, of importance we shall take the liberty to transcribe from the second volume, it is as follows: “ Cum de
 “ mensibus Aprilis et Maii ultimo elapsis Antonius Quarti,
 “ mercator Lucanus residens in villa Brugensi, a Joanne
 “ Colom, mercatore civitatis Barchinonae, etiam, residente
 “ in praedicta villa Brugensi, duo millia scutorum Philippi,

“ quolibet scuto pro xxii grossis computato, solvendi per
 “ Franciscum de Prato mercatorem Florentiae, more
 “ solito, in Barchinona, mediatim Petro Gilberto et Petro
 “ Olivo, et mediatim Petro Scorp, et supradicto Petro
 “ Gilberto, mercatoribus Cardonae: prout de dictis cambiis
 “ apparet quatuor litteris papireis, quarum tenores subse-
 “ quuntur.”

“ Superscriptio autem primae litterae fuit talis: Franc.
 “ de Prato et comp. à Barselona. Tenor vero eiusdem ad
 “ intra fuit talis: Al nome di Dio, Amen. à di xxvii.
 “ Aprile 1404. Pagate per questa prima di camb. à usanza
 “ à Piero Gilberto, è Piero Olivò scuti mille à sold. x.
 “ Barselonesi per scuto, i quali scuti mille sono per cambio
 “ che con Giovanni Colombo à grossi xxii. di g. scuto: et
 “ pag. à nostro conto, et Christo vi guardi. Subtus vero
 “ erat scriptum: Antonio Quarti Sal. de Bruggias.

“ Superscriptio vero secundae litterae fuit talis: Fran-
 “ cisco de Prato et comp. à Barsalona. Et ab intra sic
 “ habebatur: Al nome de Dio, Amen. à di xviii. di Maggio
 “ 1404. Pagate per questa prima di camb. à usanza à
 “ Piero Gilberto et à P. de Scorpo scuti mille de Felippo
 “ à sold. x. Barselonesi per scuto: i quali scuti mille sono
 “ per camb. che con Giov. Colombo à grossi xxii. di g.
 “ scuto: et pag. à nostro conto: et Christo vi guardi.
 “ Subtus vero erat sic scriptum: Ant. Quadri Sal. de
 “ Bruggias.

“ Et ita sit, quod supra dicta cambia, per supra dictum
 “ Franc. de Prato, aut aliquem alium suo nomine, soluta
 “ minime fuerint, et ex illius defectu, et praecipue ex eo
 “ quod Guilh. Colom, vt procurator supradictorum P. Gil-
 “ berti, P. Olivo et P. Scorp. emit supratàcta duo millia
 “ scutorum in praedicta civitate Barchinonae in promptis
 “ et paratis denariis, expensis vt praetendit ipsius Ant.
 “ Quarti; certa coram nobis orta sit questio inter supradic-
 “ tos Jo. Colom ex vna parte, et Ant. Quarti ex altera,
 “ dicente eodem Antonio, quod ipse Guil. Colom, vt pro-
 “ curator praedictus, praedicta insoluzione non obstante,
 “ non debebat, sumptibus et expensis ipsius Antonii,
 “ supradictas pecuniarum sumas emere in ipsa civitate
 “ Barchinonae in promptis et paratis pecuniis, sed solum
 “ debuisset illas cepisse ibidem in Tabulis, prout hoc dicit
 “ in tali casu moris et consuetudinis esse, et ab antiquo
 “ fuisse in ipsa civitate Barchinonae. Et ipsi custos et
 “ expensae, pro illis duobus millibus scutorum modo prae-
 “ dicto factae, in multo excedunt custos dictorum cam-
 “ biorum, si eadem capta fuissent ibidem in *Tabulis*:
 “ asserit saepe dictus Antonius, se illa praecisse dampna

“ Tabularum et non ampliora debere portare, supradicto
 “ Jo. Colom dicente contrarium, et quod iuxta protestatio-
 “ num litteras super hoc suo tempore factas, praedictus
 “ Antonius tolerare debet et solvere omnes expensas et
 “ et interesse, quod ex defectu dictae solutionis, per
 “ emptionem dictarum pecuniarum vel alias factae sunt, et
 “ de illis eundem Johannem reddere indempnem.”—The
Tabula here mentioned was established A. D. 1401; and
 seems to have been the original of banks for paper-money;
 the first imitation of which was formed at Genoa, in 1407.
 The importance of this topic, will certainly excuse the
 insertion of the following extract from the same publication.
 “ Este banco del cambio ò tabla, que al principio se llamò
 “ *Taula de cambi*, y estaba asegurado con el credito y las
 “ rentas publicas de la ciudad, fuè establecido primeramente
 “ en la casa de la Lonja, y era administrado por commer-
 “ ciantes, cuyos oficios de administradores, tenedores de
 “ libros, y otros elegia y tenia dotados la ciudad de su
 “ erario propio. Este util establecimiento fuè adquiriendo
 “ cada dia mayor solidez en virtud de los varios reglamentos
 “ desde su fundacion hasta principios de este siglo, que fuè
 “ quando céso el giro del cambio y la circulacion mercantil
 “ que tenian sus fondos.—Esta tabla, segun la primitiva
 “ forma y metodo de su institucion, se custodian y aseguran
 “ sin premio todos los caudales de comunidades y particu-
 “ lares en qualquiera especie de moneda corriente, abonán-
 “ dola con las debidas circunstancias de su valor intrinseco.
 “ En ella se hacen pagos y depositos por toda especie de
 “ personas: de modo que por los medios autorizados y
 “ autenticos que dimanen de las formalidades de dicha tabla
 “ quedan afianzadas la verdad y legitimidad de los creditos,
 “ y asegurada la confianza de los particulares.”

As bills of exchange, and the regulations respecting
 them, form a very considerable feature in the mercantile
 policy and laws of Britain; the following statutes, decisions,
 and chief regulations, are given from the learned Mr.
 CHITTY, with a view to elucidate this policy of that great
 and commercial people.

Form of a Foreign Bill of Exchange.

London, Jan. 1, 1793. Exchange for 10,000 Livres Tournoises.

Stamp	. At two Usances, (or at or after sight, or at or after date,)
ad. val.	pay this my first Bill of Exchange, (second and third of the same
pro temp.	tenor and date not paid,) to Messrs. ———, or order, (or
	bearer,) Ten Thousand Livres Tournoises, value received of
	them, and place the same to account, as per advice from

JAMES OATLAND.

To Messrs. ———, in Paris. }

Payable at ——— }

Form of an Inland Bill of Exchange.

Stamp ————— £100. London, Jan. 1, 1793.
 ad. val. At ————— after date, (at sight, or on demand, or at —————
 pro temp. days after sight,) pay to Mr. —————, or order, One Hundred
 Pounds, for value received. SAMUEL SKINNER.

To Mr. ———, Merchant in Bristol. }
 Payable at ————— }

The elaborate work of this author upon “Bills of Exchange” enables us to afford satisfactory information upon the following points: 1st. The proper stamp; consequences of a mistake. 2d. The superscription considered; where the bill is made. 3d. The date. 4th. The superscription of the sum to be paid. 5th. The insertion of the time of payment. 6th. The request to pay on presentation. 7th and 8th. Clauses to be inserted in foreign bills. 9th. The persons to whom payable, and fictitious payees. 10th. The insertion of the words, “or order, or bearer.” 11th. The sum to be paid. 12th. Of the words “Value received.”

1st. *Stamps.*—Anterior to the stat. 22 Geo. III. c. 33. there was no stamp duty in England, or the British dominions, which attached to bills of exchange. When bills had been made upon plain unstamped paper, and were even expressly exempted from duty, by 5 William and Mary, c. 21. § 5.; but by the 23d of the present king, certain duties were imposed, which have been repeatedly increased by numerous subsequent statutes; the first of which was 37 Geo. III. c. 90. But since the 10th of October, 1804, *i. e.* 44th of the present king, c. 98. § 1, 8, 20, 21, 24, and in the schedule A. *the amount of duty* on foreign bills, &c. is regulated: *i. e.* on foreign bills, drawn in sets, upon each bill of the set; if not exceeding £100, a duty of 1s.; not exceeding £200, a duty of 2s.; not exceeding £500, a duty of 3s.; not exceeding £1000, a duty of 4s.; if above £1000, a duty of 5s.

Inland bills of exchange, promissory notes, &c.

If above £5 5s. and not exceeding £30 a duty of 1s. 6d.

If .. 30 .. 50 .. 2 0

If .. 50 .. 100 .. 3 0

If .. 100 .. 200 .. 4 0

If .. 200 .. 500 .. 5 0

If .. 500 .. 1000 .. 7 6

If exceeding 1000 .. 10 0

Promissory notes, payable to bearer on demand, which

may, within three years after date, be re-issued after payment at any place.

If not exceeding £1 1s. a duty of 0s. 3d.

If .. 2 2 .. 0 6

If .. 5 5 .. 0 9

If .. 20 0 .. 1 0

Drafts, checks, &c. payable to bearer on demand, and drawn on a banker, residing, or transacting the business of a banker, within ten miles of the place where such drafts, &c. are drawn, are exempt from duty, provided the place where drawn be expressed in or upon such instrument. A similar exemption exists with respect to, and in favour of bills drawn by commissioned officers, &c. for wages, or pay. Act of 44 Geo. III. c. 98. § 8. renders the provisions of the former acts in force before, or on the 10th of October, 1804, applicable to the present stamp duties on bills, &c.

With respect to foreign bills, it is clear that the legislature did not mean to extend the stamp duties, imposed by those acts, to such foreign bills as are made abroad.²

With respect to the excepting clause in favour of checks drawn upon bankers, it has been holden, that the person on whom the check is drawn, must be *bonâ fide* a banker,³ and that a draft on a banker post-dated, and delivered before the day of the date, though not intended to be used till that day, must be stamped.⁴ And according to the 44 Geo. III. the place where the check is drawn, ought to be truly stated.

Persons giving such bills, &c. not duly stamped, as well as those who acknowledge their operation by payment, without the terms of the act being complied with, in respect to proper stamp duty appearing upon the instrument, are subject to a penalty of £20, under the 10th sect. of 31 Geo. III. It is also provided by sect. 19, that unless the paper be stamped, it shall not be *received in evidence in any court of justice whatever*. And the commissioners were forbidden to stamp any such after it was made. However, with respect to this clause, it was subsequently discovered necessary to pass a *temporary act*, whereby the commissioners of His Majesty's stamp duties were enabled, upon proof by the holder that no fraud was intended, to stamp bills after they were drawn, on payment of a certain penalty.

² 7 Term Rep. 601.

³ Bayl. 24. b. 1 Show. 164.

⁴ 1 East, 435. 3 B. and P. 559.

An authority was given to the commissioners of stamps by 37 Geo. III. c. 136. § 4. at any time before the 1st of November, 1797, to stamp bills, &c. with additional duty, without subjecting the party to any penalty, &c.

Date.—The *date* of the instrument ought to be clearly expressed; and although it is the common practice to write the date in figures; yet in order to prevent intentional or accidental alteration, which may invalidate the instrument, even in the hands of an innocent holder, it may be advisable to write the date at full length, in words.

It appears, however, that a date is not, in general, essential to its validity; for where a bill has no date, the time, if it be necessary to be inquired into, will be computed from the day it was issued; and if a bill of exchange be made payable two months after date, and no date expressed, the court will intend it to be payable in two months after the day on which it was made. With respect to date, also, it should be observed, that bills given for a sum above twenty shillings, and under five pounds, without being negotiable or transferrable; or on which twenty shillings, or above that sum should remain undischarged, shall bear date before the drawing or issuing thereof, and not at any day subsequent.

Superscription of the Sum.—There is no necessity for the superscription of the sum for which a bill is payable, provided it be mentioned in the body; but as the superscription will aid an omission in the body, it is the advice of *Beaves*,⁴ that the sum payable, be expressed both in words and figures, that no exception be taken to the instrument; and it is now usual to express the sum payable in figures at the head, and in words in the body of it. In drawing a check on a banker, the sum is generally subscribed.

By a French ordinance, it is required that bills of exchange, made in that country, express the *time when they are to be paid*, or otherwise they will be invalid. There is no existing regulation in Britain to that effect. However, it is advisable to express it clearly and intelligibly. With respect to time when payment is to be made, it depends entirely on the agreement of the parties; there is no limitation in point of law, though the payment must not be contingent.⁵ Negotiable bills and drafts under five pounds, of the above description, must be payable within twenty-one days after date, by 17 Geo. III. c. 30. The operation of this act is suspended with respect to drafts payable to

⁴ Pl. 3, et vid. Mar. 139.

⁵ Willes, 396.

bearer on demand, by stat. 37 Geo. III. c. 32. and other subsequent acts. Foreign bills are drawn payable at usance, or usances; but they, like inland bills, may be drawn payable at sight, at days, weeks, months, or years, after sight or date, or on demand. *Bills*, however, are very seldom drawn payable on demand; but usually when it is intended they should be payable immediately, are drawn payable *at sight*. If so drawn, the drawer of a foreign bill should express that it is payable according to the course of exchange at the time of making it, or otherwise, it seems, the drawee must pay according to the exchange of the day when he has sight of the bill. Checks on bankers very seldom express any time when they are to be paid, and consequently are payable as soon as the person to whom they are given can present them.

The only misfortune attending this instrument which has occurred to our knowledge, is, when a party who has a check may have omitted to present it immediately, the banker has stopped payment in the interim between his receiving it and offering it for payment; in which case he has overheld it at his own risk, and in consequence has completely made the transaction a private debt between the banker and himself.

Beawes says, in his *Lex Mercatoria*, that payment of a bill should be ordered and commanded; Chitty says, it is sufficient if it be requested; and according to Marius, the direction to pay the money need not be contained in the body of the bill, or even on the same side of the paper.

Inland bills, checks, and notes, consist of only one part, but foreign bills in general consist of *several parts*, in order should the bearer lose one, he may receive his money on the other; but if the drawer only gives one bill, he will, should that be lost, be obliged to give another of the same date to the loser. The several parts of a foreign bill are called a *set*; each part containing a condition that it should be paid, *provided the others remain unpaid*; in other respects they are all of the same tenor. This condition should be inserted in each part, naming every other part of the set.

The forgery of an indorsement of the payee, on one of the parts, will not pass any interest, even to a *bonâ fide* holder, and the real payee may sustain an action on the other part.⁶

A bill of exchange and promissory note must specify *to*

whom it is to be paid; and it is said, that otherwise it will be merely waste paper. But Pothier has observed that if the name be omitted, the presumption is to be regulated by the statement of the party of whom value was said to have been received; which appears very equitable. Care should be taken that the name of the party, when it is inserted, be properly spelled;⁷ and where there are two persons of the same name, the payee should be described in such a manner that no mistake can occur. And bills under £5, described by stat. 17 Geo. III. c. 30, are required by that statute to express the names and places of abode of the persons respectively, to whom or to whose order the same shall be payable. A bill may be drawn payable to bearer, in which case delivery alone transfers it. In France, it should seem such bills were at first unlawful, but they have been subsequently established. Originally, bills were given in that country, with a blank for the holder of the bill to insert any name he might think proper; but this practice was found to be so replete with usury and fraud, that it was afterwards prohibited. A bill payable to a fictitious person or order is in effect a bill payable to bearer; all parties concerned are subject to a declaration, knowing the payee to be a fictitious person. As the use of fictitious names has been highly censured, the person indorsing the fictitious name on the bill to give it currency would be guilty of forgery.⁸

As it is not necessary or essential to the validity of a bill of exchange, that there should be three parties to it, a bill may be made payable to the drawer himself; though, in such a case, it is said to be more in the nature of a promissory note. A bill payable to a married woman is payable to the husband, and transferrable in his name.⁹

Advantage of negotiable Bills.—In a commercial point of view, it was on account of this advantage that our courts allowed in their favour an exception to the rule relative to the assignment of *choses* in action: it was once thought that unless this was possessed, they could have no more effect than as a matter of evidence of some contract.¹⁰ It is, however, at present established, that it is not essential to the validity of a bill, as an instrument, that it be transferable. If intended to be negotiable, care must be taken that the operative words of transfer commonly used in bills be inserted. This mode is to draw it payable to A. B. or order,

⁷ Beawes, pl. 3.

⁸ Leach, Crown Law, 206.

⁹ 1 East, 432. 4 T. R. 616.

¹⁰ 3 Wils, 211.

or to A. B. or bearer, or to drawer's own order, or to bearer generally.

The *sum* for which bills are drawn should be clearly expressed in words at length in the body; and as previously observed, it is also usual to write it in figures at the head. The first caution may prevent forgery, and the second may supply a defect in the former; and in an indictment for forgery, an omission in the bill has been aided by its superscription.¹¹ If the sum in the superscription be different from that mentioned in the body, that specified in the body will be taken *prima facie* to be the sum payable.¹² As it respects foreign bills, there is no restriction as to amount. But inland bills are different, as are drafts, which are forbidden by law, for any sum under twenty shillings, under a penalty of £20. Vide 15 Geo. III. cap. 51.

As to value received for a Bill.—In France, it appears it was not only necessary to the validity of a bill, that it should express whether or not value had been received, but likewise the nature of the consideration constituting that value;¹³ but in this country it is otherwise, as *value received* is implied in every bill and indorsement, as much as if expressed *in totidem verbis*.¹⁴ And although there are some old cases¹⁵ on the question, whether *indebitatus assumpsit* would lie on a bill of exchange, in which it appears there was a distinction made between a bill importing to have been given for value received, and one not containing those words; and it was holden that in the first case the drawer was chargeable at common law, but in the latter on the custom only;¹⁶ yet it is now settled that there is no such distinction, and that a bill need not contain those words.¹⁶

To entitle the holder of an inland bill or note for £20, or upwards, to recover interest and damages against drawer and indorser in default of acceptance or payment, it should contain the words “Value received.”¹⁷ If a bill or note contain those words, an action of debt may be sustained by the payee against the maker of each.¹⁸ These distinctions

¹¹ 2 Past. Pl. Cr. 951.

¹² Beawes, pl. 193. Mar. 2d edit. 138, 9. 2 East Pl. Cr. 951.

¹³ Poth. pl. 8. 34.

¹⁴ Claxton v. Swift, 2 Show. 496. White v. Ledwick, B. R. H. 25 Geo. III. Bayl. 13. n. a. Ld. Raymond 1481. Fort. 282. 8 Mod. 267. 1 Barnard, 88. Lutw. 889. 1 Mod. 310, *acc.* 3 Wils. 212. 2 Stra. 1212, *semb. contra.* 2 Black. Com. 468.

¹⁵ Beawes, pl. 233. Show. 5. Vin. Abr. tit. *Bills of Exchange*.

¹⁶ Same cases as in note 14.

¹⁷ 9 & 10 Wm. III. c. 17. 3 & 4 Ann. c. 9. sec. 4. Kyd, 148, 9. Bayl. 75.

¹⁸ 2 B. & P. 78. 81.

may render it necessary in all cases to insert the words; and the words alluded to may be inserted at time of trial.¹⁹

Here we may take a concise view of *the consideration on which a bill of exchange may be originally founded, or which may pass between the indorser and indorsee, &c. on transfer..* In this inquiry the chief points which present themselves as affecting the validity of the instrument, are—

1. The *want* of consideration: 2. The *illegality* of it.—

It has been already observed, that a contract not under seal is invalid, unless founded upon good and valuable consideration; that it is incumbent on plaintiff to state such consideration in his declaration, and to prove it on trial, before he can call for the defence of the defendant. But bills of exchange which partake in this respect of the quality of a bond, it is not held necessary for plaintiff to state any consideration, either in his declaration, or to prove it incorrect, unless where he brings his action as bearer of a bill which is transferrable by delivery, and then only under suspicious circumstances: as where it has been lost,²⁰ &c. and whenever the holder has given full value for the bill, &c. the defendant will not be at liberty to show that he has received none, although the plaintiff knew that circumstance at the time he became the holder, unless he also knew that the party from whom he received it was acting fraudulently. C. J. EYRE observed, “No evidence of want of consideration, or other ground to impeach the apparent value received, was ever admitted in a case between an acceptor or drawer and a third person holding the bill for value; and the rule is so strict, that it will be presumed he does hold it for value till the contrary appear. The *onus probandi* lies on the defendant. If it can be proved that the holder gave no value for the bill, then indeed he is in privity with the first holder, and will be affected by every thing which would affect that first holder. This all proceeds upon an *argumentum ad hominem*; it is saying you have the title, but you shall not be heard in a court of justice, to enforce it against good faith and conscience.” “For the purpose of rendering bills of exchange negotiable, the right of property in them passes with the bills. Every holder with the bills takes the property, and his title is stamped upon the bills themselves. The property and the possession are inseparable. This was *necessary to make them negotiable*, and in this respect they differ essentially from goods,

¹⁹ Bul. N. P. 275. *sed qu.*

²⁰ Burr. 1516. 4 Esp. Rep. 56.

in which the property and possession may be in different persons."

Lord ELDON also is reported to have decided that a bill of exchange given for a particular purpose can be applied to no other, beyond the limits of such restriction. But where a bill is given under no such restrictions, but given merely for the accommodation of either party, and sent into the world, it is no answer to an action brought on that bill, that the defendant, the acceptor, accepted it for the accommodation of the drawer, and that the fact was known to the holder; in such case if the holder gave a *bonâ fide* consideration for it, he is entitled to recover the amount, though he had full knowledge of the transaction.

In the case of bills payable to bearer, Lord MANSFIELD observed, that if the bearer bring the action, he ought to entitle himself to it, on a valuable consideration, and strictly to prove his coming by it *bonâ fide*.²¹ In other cases where it is expected that a defence will be attempted on want of consideration, the plaintiff should be prepared on trial to prove the value given for the bill, &c.

Between the drawer and the acceptor, the drawer and the payee and his agent; the indorsee and his immediate indorser, the *want* of consideration,²² or the *sufficiency* of *amount* thereof,²³ may be questioned; and where a bill is given for accommodation, and the holder has given value only for a part of the amount, he cannot recover upon the bill beyond that sum;²⁴ but when a bill is drawn for money really due from drawee to drawer, in such case the indorsee, though he have not given to the indorser the full amount of the bill, may recover the whole, and be the holder of the overplus to the use of the indorser.²⁵ In the case of a person taking a bill by transfer after it is due, any party to the bill, who is sued by him, will in general be at liberty to insist on his not having received a valuable consideration.²⁶ According to a late case,²⁷ it does not appear to be settled whether a promissory note given by the maker to the payee as a *gift*, without consideration, can be enforced. If a bill be fraudulently obtained, a court of equity will relieve, and detain the bill.²⁸

²¹ 3 Burr. 1527.

²² Stra. 674. 2 T. R. 71. 7 T. R. 121. Ld. Raymond, 759. Bul. N. P. 274, 5. 3 T. R. 421, 2. 2 Show. 235. 1 Esp. 117, 261 *acc.* 2 Bla. Com. 446, *contra*, but see Mr. Christian's note.

²³ Peake's Rep. 61, 216. 1 Esp. Rep. 262.

²⁴ 1 Esp. Rep. 261.

²⁵ Id. Ibid. Cooke, 157.

²⁶ But as to time of indorsement, 7 T. R. 630.

²⁷ Tate v. Hilbert, 2 Ves. j. 115, 121. Toller, L. E. 182, 3.

²⁸ 2 Ves. 445.

Whenever the defendant is at liberty to insist on the want of a consideration as a defence, he may also insist that the consideration was *illegal*.

A contract is always legal, if it be not repugnant to the revealed *law of God*, or the *general policy of the common law*, or some *legislative provision*. As to the objection of illegality in a contract, &c. see 1 B. and P. 554. 1 Fonbl. 345. Illegal considerations have been considered as distinguished into three heads, 1st. The doing an act *malum in se*, or *malum prohibitum*; 2d. The *omission* of the performance of some legal duty; and 3d. A stipulation encouraging such crime or omission. 1 Bla. Com. 57, 8. Co. Lit. 206, b. n. 1. 1 P. Williams, 189. 1 Bos. and Pul. 340, 1; 556. But the difference between *malum in se* and *malum prohibitum* has recently been denied. 2 B. and P. 375. Sedgwick on Bla. Com. 54, sed vide 4 Esp. R. 264. Illegal considerations may be those void at common law, and those void by statute. Those of the first class are such as are prejudicial to the *community at large*, or those which affect the interest of any *individual*: as, 1st, stipulations in *general restraint of trade*; as if a party engage not to carry on a trade in any part of England; but if the restraint be qualified, so as to preclude the party from trading within a given distance, say ten miles, and the breach of stipulation tend apparently to the detriment of the party in whose favour it was made, and a consideration was given by such party, the contract will not be impeached either at law or in equity. 2 Saund. 156, n. 1. 1 East. 190. 1 P. Williams, 190. 10 Mod. 130. Co. Litt. 206, b. n. 1. 5 T. R. 118. 1 Pow. 167. 2dly, A stipulation repugnant to *Custom* and *Excise* laws of this country, as smuggling, &c. 3 T. R. 454. 1 East, 97. 1 B. and P. 551. 1 Bl. R. 445. 1 Doug. 254. 1 Marshal on Insurances, c. 5.—3dly, *Dropping a criminal prosecution*, or suppressing evidence, or soliciting a pardon, or compounding a felony, or other public crime. 3 T. R. 17. 2 Esp. R. 643. 7 T. R. 475. 5 East, 294. 3 P. Williams, 279. 2 Wils. 349. 3 Esp. R. 253. 4thly, The recommendation to, or purchase of an office under government. Bro. C. C. 114. Bayl. 122. 5thly, Every *illegal wager* repugnant to general policy, as a wager between voters on the event of an election, 1 T. R. 56; upon the event of a war, 7 T. R. 535. 1 T. R. 57; or concerning the produce of any particular branch of the revenue, &c. as of hop duties. 2 T. R. 610. 2 B. and P. 130. Cricket, a horse-race or foot-race against time, are games within the statute of 9 Anne, c. 14, s. 1. 1 Wils. 220. 2 Wils. 36. 6thly, In

general *restraint of marriage*, Burr. 2225. 7thly, *Procuration of marriage*, Co. Lit. 206, b. 8thly, *Future illicit cohabitation*, but past cohabitation is a legal consideration, Burr. 1568. 2 P. Williams, 432. 2 Wils. 339. Ambl. 641. Cowp. 742. Forrest, 153. So a promissory note given to *indemnify a parish against a bastard child* is illegal, as being contrary to the general policy of the law, as well as the letter of 6 Geo. II. c. 31. 6 East, 110. But the release by an excise officer, of a person apprehended for penalties under excise laws, will be a sufficient consideration for a note, the commissioners having approved of his taking it. 2 B. P. 151. So any stipulation prejudicial to the feelings or interest of a third person is illegal, Cowp. 729. 2 Lev. 161. However, at common law, a wager is legal if it be not an incitement to a breach of the peace, or to immorality, or if it do not affect the feelings or interest of a third person, or expose him to ridicule, or libel him, or if it be not against sound policy. 3 T. R. 693.

Secondly.—Some considerations as well as contracts are deduced to be invalid by statute; as usury, 12 Anne, stat. 2, c. 16, which has two provisions, first, avoiding all bonds, contracts, and assurances, for payment of money to be lent, whereon shall be reserved a greater rate of interest than five per cent.; also subjecting the party taking above that sum to an action for treble the sum lent or forborne, &c. and on this statute the security is also void, though on the face of it, it should appear legal, if there be any other illegal private stipulation, for matter dehors the security, may be pleaded if it be illegal. 3 T. R. 424. Doug. 235. Usury also affects the contract in the case of a bill of exchange, even in the hands of a *bonâ fide* holder, *Lowe v. Waller*, Dougl. 735. 8 T. R. 390. 1 Saund. 295. 1 East, 92; but a second security given to a *bonâ fide* holder of a bill, is in some cases valid. It is not usury, though improper, for an acceptor to discount his own acceptance at a premium, 4 East, 55.

A gaming consideration is declared illegal by statute 16 Car. II. c. 7, and 9 Anne, c. 14; 1 Pow. 207. Bac. Abr. tit. *Gaming*. The first statute voids all securities, whether written or verbal, to secure any sum of money exceeding £100 lost at play; but 9 Anne, only voids *written* contracts, and an action of *assumpsit* will lie to recover money won at play, not amounting to £10, 1 Esp. Rep. 235. Under these statutes a bill of exchange or promissory note, given for a gambling transaction, is declared illegal and void, even in the hands of a *bonâ fide* holder. 2 Stra. 1155.

So gaming in the lottery, stock-jobbing, gaming on ships' policy, or lives; trading against the laws of the East India Company; the purchase of a vote, or bribery at an election; a stipulation to a sheriff, for *ease and favour*, or a contract in consideration for signing a bankrupt's certificate, are all declared illegal by several specific statutes.

A bill of exchange, being in its nature a letter of request from the maker to a third person in favour of a second, must be properly addressed to that person. Poth. pl. 35. Beawes, pl. 3. Mar. 143. The Dutch and Italians write the address on the back of a bill; but the French, in all cases, and the English in case of an inland bill, subscribe the direction in the form to which this paragraph refers.

Place where payment is to be made should be fully expressed in the subscription, or body of the bill; Mar. 107, 8. If a bill be drawn upon a person not being at the place where the drawer intends the bill is to be payable, the place where the drawee resides, as well as the place where the drawer resides, and the place where payment is to be made, are to be expressed.

BLACK LEAD.

The period when this semi-metallic substance was introduced, for the purposes to which it is now applied, cannot with certainty be ascertained, as no record is found of the transaction: by the common expedient of inference, however, we certainly may conclude it was in very remote ages. For transcribers of MSS. upwards of 1000 years ago, used a substance somewhat resembling it in effect; although, we confess, the probability that those lines of theirs being written on skin, might, perhaps, require a substance somewhat harder, therefore they might have had recourse to common lead; and also, because that substance might be used with as severe a pressure, as the impressions left by the instrument in rufing appears to have sometimes made. Likewise, also, then we may conceive the strength necessary to be used, bore some resemblance to that which they exerted in the use of the stylus, an iron or steel instrument, which they had to write upon their tablets, or thin plates of wood, ivory, or some such substance, and covered with wax. This instrument was made pointed at one end, and flat and smooth at the other: hence, we understand the text of *Horace*, when he speaks of "*the frequent necessity for an*

author to turn the style," i. e. to rub out something which he had already written, or the necessity for correcting his work, and inserting an improvement or amendment in his composition.

"O that my words were now written! oh that they were IMPRESSED in a book! That they were graven with an *iron pen and lead* in the rock for ever!" *Job*, xix. v. 23, 24. These are to be viewed as the *words* of the translators alone, to give the *sense* of the author. Their authority, therefore, cannot impart much consequence to the present question. This quotation is made for the purpose of showing that such instruments were presumed to have been in use for the purposes which we have mentioned, in the time of the writing of that beautiful sacred composition; which is allowed to be one of the most ancient of the sacred books, and presumed to have been written by the *Hebrew* legislator, MOSES himself, and known to be in the most ancient *Samaritan* character, as St. Origen and St. Jerome inform us.

The geological name of this semi-metallic substance is *plumbago* and *molybdæna*,—a distinction is made by modern mineralogists in those names; as they call the mineral used for black-lead pencils, *reissbley*, *plumbago*, or *graphites*: by *wasserbley* and *molybdæna*, they understand a mineral at one time considered the same; but now a more accurate distinction is made, the terms stand for the article as above given. The latter named mineral was once considered the same as the former, from a general resemblance; but upon closer examination and experiments, it differs in being heavier, occurring more seldom, and containing a new metal, almost of a steel gray colour, and exceedingly brittle, and which is likewise called *molybdæna*. Plumbago, the substance here meant, when exposed to an open fire, becomes almost entirely consumed, leaving behind nothing but a little iron and siliceous earth; containing no lead whatever. That designated by *reissbley* and *bleystift*, according to German nomenclature, have no other foundation; or any stronger claim to the plumbageous substance, or to the metallic character, other than in *appearance*; leaving a lead coloured trace upon paper. The darker, more fine, and clearer the lines it makes are, the more is its fitness for drawing or writing. These traces do not readily fade; but may be by art removed: hence its superior utility for many purposes, and its preference in some cases, to chalk or ink.

Pliny says, *Argento, ære, plumbo lineæ ducuntur*. This sentiment is presumed to have reference to common lead.

Those deeply indented lines we have mentioned as visible

in ancient MSS. are presumed to have been made with the keen edge of a round plate of lead, which the Greeks called παραγραφος, also τροχαλος, γυρος, κυκλοτηρης, which last word denotes the form. The latter Romans named it *præductal*. The rule by which those lines were drawn, the Greeks denominated κανων and κανονις, which *Catullus* calls *membrana directa plumbo*, from some wretched verses with which *Suffenus* filled a tablet so ruled. *Pollux* hath παραγραφειν τη παραγραφιδι. Vide *Salmasius ad Solinum*, p. 644, where some passages will be found, in which those plates are described, quoted from the ANTHOLOGIA. Of some we give a translation: *orbiculare plumbum, quod semitam novit sculpere, recta radens in rectum extensam regulam*. Others are seen in some lines of *Catullus*, xxii. 7, p. 71. Also in the annotations of *Vossius* on that author, p. 54; and *Hugo de scribendi origine*, and others, borrowed from *Saumaise*. *Pollux*, iv. p. 258.

Le Moine cites a document of the year 1387, which is, as he says, ruled with *black lead*. He also says, the custom of ruling for writing ceased some time about the beginning of the fifteenth century, and that after that period the lines became crooked and oblique.¹

But, perhaps, the antiquity of the use of black-lead pencils cannot be so well determined from diplomatiques, as their frequency might be proved from mineralogical writers and natural historians. The first mention discovered of these latter, occurs in the works of *Conrad Gesner*, who, in his book on Fossils, published at Zurich, anno 1565, says, that that people had pencils for writing with wooden handles, inclosing a piece of lead, which he believed to be an artificial composition, and it was called *stimmi Anglicanum*;² which seems to import that it was a British production, and we should consider from the name of this British antimony being given to it, that it might have been Cumberland black-lead. A figure also accompanies the description, from whence it appears to have been included in a wooden sheath or covering.

About thirty years afterwards *Cæsalpinus* gave a more perfect account of this mineral, which he calls *molybdoides*, which name he thinks he finds in *Dioscorides*. He

¹ Diplomatique-pratique, a Metz, 1765, 4to. p. 62: Les lines sont tirées au crayon de mine de plomb.

² Stylus inferius depictus, ad scribendum factus est, plumbi cujusdam (factitii puto, quod aliquos stimmi Anglicum vocare audio) genere, in mucronem derasi, in manubrium ligneum inserti. *De rerum fossilium figuris*, p. 104.

says, it was a lead-coloured shining stone, smooth as glass; appeared as if rubbed over with oil; it gave to the fingers an ash-grey tint, with a plumbeous brightness; and adds, pointed pencils were made of it for the use of painters and draughtsmen; that it was then called *Flanders' stone*, because it was brought from the Netherlands to Italy.³ A closer description of the substance than this cannot be discovered; agreeing in every particular, except its native soil, and which is accounted for.

Somewhere about three years afterwards, a still more perfect description was furnished by Imperati, who calls the black-lead *grafio piombino*; and he says it is much more convenient for drawing than pen and ink, because the marks made with it appear distinct upon a white ground; also in consequence of their brightness show themselves on black; but because they may be preserved or rubbed out at pleasure; also, because one can retrace them with a pen, which, he says, lead or chalk will not admit. This mineral is smooth; appears greasy to the touch; has a leaden colour, which it communicates with a metallic brightness. It can resist, for a long time, the strongest fire, and even from it acquires more hardness; it has in consequence been thought to be a species of *talc*. This, in the arts to which it is applied, is a property that highly enhanceth its value; being manufactured into crucibles, &c. with clay. These vessels are capable of standing the strongest heat of a chymical furnace.

Sometimes this lead is foliaceous, and may be crumbled into small pieces or scales; but frequently found denser and more strong. This latter is what writing pencils should be made of; but the former being more frequently found, and also coming from the refuse of the workmen, is too often mixed up with some glutinous substance, and there is reason to suppose it to be enclosed in the groove in a pliant state; those pencils are commonly hawked about our streets by pedlars and Jews.

Out of this last described lead the before-mentioned vessels are also manufactured, being mixed with a clay called *rubrica*.⁴ From what Imperati has said, we may infer, the

³ Puto molybdoidem esse lapidem quendam in nigro splendentem colore plumbeo, tactu adeo lubrico, ut perunctus videatur, manusque tangentium inficit, colore cinereo, non sine aliquo splendore plumbeo; utuntur eo pictores coticulis in cuspidem excisis, ad figuras designandas; appellant autem lapidem Flandriæ quia ex Belgio affertur. *De metallicis libri tres*. Noribergæ, 1602, 4to. p. 186. First edition published in Rome, 1596, 4to.

⁴ Dell' *historia naturale di Ferrante Imperato*. In Napoli, 1599, fo. p. 122.

Italians well knew, at that time, the nature, use, and application of that mineral. *Justi* considers it as a species of talc.

Bartholomew Ambrosinus,⁵ in his continuation of *Aldrovandi's* large work on natural history, printed at Bologna, 1648, uses the name *lapis plumbarius*. The short account he gives of it is taken from the two preceding Italians: but he considered the figure furnished by Gesner of sufficient moment to give a larger representation of it.

When the mines at Leizersdorf, which furnish materials for those crucibles made at Ips or Passau; and likewise when those of Cumberland were first opened, we confess, we have not been enabled to learn. These latter mines are situated in the Borrowdale mountains, about ten miles from Keswick. The proprietors of which, according to an old established regulation, open them once in every seven years, and then take out only a given quantity, lest they should be exhausted. There they call it *black lead*, *kellow* or *killow*, *wad* in Cumberland, or *wadt* in Germany; which latter words import blackness. The most ancient information respecting these pits, we have found occurs in the writings of *Merret*, anno 1667, who calls this mineral *nigrica fabrilis*, presumed from his want of knowing the proper Latin name. Robinson, in his essay towards a natural history of Westmorland and Cumberland, London, 1709, 8vo. p. 74, relates that at first the country people around Keswick marked their sheep with it. Afterwards they discovered the art of employing it in their earthen-ware; and as a preventive to preserve iron from rust. This author also says, the Dutch use it in dyeing, to render black more durable; and that they buy it in large quantities for that purpose. But their application of it for dyeing is highly questionable. Spain and France both produce this mineral: in the former it is found in the neighbourhood of *Ronda*, a town in Grenada; and, in the latter it was discovered, at a late period, in Upper Provence, near *Curban*, on the banks of the *Durance*, between *Sisteron* and *Gap*, whence it is sent to Marseilles.⁶

The mode of eradicating the marks of black lead by

Another description of it is given in p. 133 and 768, in a Latin edition printed at Cologne, in 1695.

⁵ *Aldrovandi musæum metallicum*, p. 167, 177.

⁶ In commerce, it is called *pot-loth*; presumed from the Dutch name of that mineral, who call it *pot-loot*, i. e. *potters' lead*, from its being used in the *crucible* potteries.

means of an elastic gum, called *caoutchouc*, or *Indian rubber*, was, we have been informed, first discovered in England, between thirty and forty years ago.

CHIMNEYS.

Notwithstanding we know the opinion of the learned, with respect to this article, inclines them to believe that anciently houses were built without the essential convenience of flues to carry off the smoke, we would ask why they conceive the wise of antiquity to be so remarkably blind to their own comfort and convenience? They will answer, because they find no mention of them in *Pliny*, *Vitruvius*, or any writer where they might expect to have discovered it. We rejoin, provided the modern learned are such simpletons, to oppose literary authority to the actual dictum of common sense and nature, we dare not argue with them, without incurring the hazard of offending. Without presuming upon our own learning, we would submit to them and to the world the result of our inquiries, observations, and reflections, without consuming much of their valuable time in a waste of language: first considering the nature of the thing; next, briefly the heads of opinions which have been urged against it; thirdly, such passages we beg to point out where we conceive they may convince themselves; fourthly, we quote still existing examples; and fifthly and lastly, we appeal to their *own sense of convenience*.

In the origin of all societies, man doubtless lived long before he knew the benefit of that shelter which even humble buildings afford; the author of *Archæologia Græca* informs us so, and *Diodorus Siculus*, who lived nearer to that period, if proximity with regard to time is of any avail in this case, confirms in his first book what the learned Archbishop *Potter* has since asserted. Taking this position therefore, for proved, we proceed to observe, that it may be probable man was, in an extremely ancient period, acquainted with the benefits derived from fire; this we will presume, that he had even known its utility previous to his having the idea of deriving comfort from the aid of his first rude efforts at architecture; he discovered that it was a natural property in smoke to ascend; he, at first, might suit the situation where he would kindle a fire to the best mode of accommodation in this respect, to avoid its suffocating effects, and that injury offered to the eyes from

the alkali of vegetable smoke. His first rude efforts at architecture were like those which *Tacitus* describes, as possessed by the ancient inhabitants of Germany. Similar edifices we have still in many parts of the British empire, *i.e.* in the Scottish Highlands, particularly in the isle of *Stromata*, where there are substantial edifices of stone rudely put together indeed, but their antiquity is ascertained even by their form. These are built like those huts described by *Tacitus*, as common among the *Teutones*. Being of a round figure, with an aperture in the centre to permit the escape of smoke. So are constructed numerous cottages in the mountainous parts of Wales, at this day, with a like aperture, or else with one at the most sheltered end of the house; sometimes cut through the perpendicular wall, and more or less approaching to the nature of flues.

On the other hand, from eleven opinions of modern commentators, upon the writings of the ancients, we have consulted, we discover only two who believe in the existence of chimneys among the ancients; four who are doubtful; and, strange to say, five who deny it altogether. At the head of those who support the affirmative, one appears, who is himself a host, we need scarcely say, that he is the learned *Montfaucon*.

In the dramatic writings of *Alexis*, a poet contemporary with Alexander, one asks—"Boy, is there a kitchen?—Has it a chimney?"—"Yes; but it is a bad one—the eyes will suffer." Before this, in *Homer*, *Ulysses* wished, whilst in *Calypso's grotto*, to see the smoke ascending from Ithaca;—his mind unquestionably adverted, from what was then in reality, perhaps, to what was mentally before his eyes,—he wished to see the circling fumes ascend from the chimneys of his own palace. *Athenæus* has preserved a passage of *Diphilus*, in which the poet says of a parasite, when he is invited to the house of a rich man, he does not look to the magnificence of the building, or the elegance of the furniture. "If I see," says he, "the smoke rising up in abundance, quick, and in a straight column, my heart is rejoiced, for I expect a good supper." We submit also, that the following passage of *Seneca* clearly indicates the thing we are proving, where, he says,—"Last evening I had some friends with me, and on that account a stronger smoke was raised; not such a smoke, however, as bursts from the kitchens of the great, and which alarms the watchmen, but such a one as signifies guests are arrived." The author means his fire produced a volume of curling, ascending, hospitable

smoke, and opposed this *idea* to the one of those dark voluminous masses of smoke which often ascend from chimneys on fire; therefore the watchmen then, as we now find them, alarmed the neighbourhood when such an event took place, fearing the destruction of the house, and other ill consequences.

Horace, being on a journey, stopped at a paltry inn, where he complains, “that the smoke affected his eyes.” Have we not similar houses with smoky chimneys now-a-days; the inference to be deduced from this, in our humble opinion, is, that the poet was *better* accommodated in his *own house*, or he would not have discovered the inconvenience. It is also universally admitted, that the ancients had *sudatoria*, or sweating-rooms; they had also rooms warmed by flues; now to us it really appears to be obstinate, for the sake of contradiction alone,—to insist that the smoke would not naturally follow the same road meant to convey the heat. *Vitruvius*, also, speaking of the manufacture of lamp-black, says, “The places where this was procured, consisted of huts built for *the purpose*, when the smoke of burning pine-wood was *conveyed to a close apartment*.” The natural question which here presents itself, is, by what means was it conveyed? if not by a flue or *chimney*, how could it be collected? Those proofs we have selected from ancient authors, we believe, may be sufficient to establish the opinion, though the united learning and prejudice of the whole modern world were against us. We deliver it as our most decided opinion, that the ancients *had* chimneys in some of their apartments; although we, at the same time, admit they were not so general, as we now find them in northern European and cold countries.

COBALT, SMALT, AND ZAFFER.

These three substances being produced from the self-same material, and nearly by the same identical process, their history is comprehended in one article. We have often had occasion, in the course of our researches, to confess our gratitude to the Sisyphean labours of the alchemist; useless indeed, to him, but infinitely beneficial to mankind and posterity in the noble art of chymistry and its dependants. In nothing is man more benefited than in the very valuable discoveries made in the mineral world by various degrees of chymical heat, those degrees ascertained to be requisite for the fusion of certain metals; and the production of

certain substances were never discovered till the alchemical eye had been accustomed to survey its fires, for years, with the scrutinizing glance of inquisitorial curiosity, expecting,—anxiously expecting, to discover that substance realized, which would repay his never-ceasing solicitude, and immortalize his name. He consequently watched every change of colour; every minute circumstance he caught with the vision of an eagle. He, however, missed his ultimate object, but, unwittingly, conferred benefits, by his labours, upon *real science*, which the world will ever have to acknowledge with unfeigned gratitude. The same compliment is also due to what is now viewed in European climes as another chimerical science,—judicial astrology, once the general pursuit of Europe as well as Asia, where it is still in its glory, gave being to the noblest discoveries in the celestial science of astronomy.

The name *cobalt* is given at the present moment to all such minerals as contain a semi-metal, the calx or matrix of which can be melted into blue glass, or which is found to communicate a blue tint to common glass; and is consequently conducive to the purest crystal, provided it has not too much colour; there being a certain slight degree of blue in the most perfect white colour, or rather, in the purest colourless bodies which can be discovered. The metal itself, if metal it can be called, correctly speaking, rather the *mineral itself*, is fit for no particular purpose, the calx being only useful. It is first roasted and freed from all foreign impurities; then it is well calcined, and sold as an article of commerce, mixed or unmixed with fine white sand, under the name of ZAFFER (*zaffera*;) or it is melted with siliceous earth and potash to a certain species of blue glass, called *smalt*, which, when ground very fine,—to an impalpable powder, is known to the commercial world as powder-blue. These several articles becoming most valuable pigments; because they best withstand fire without any injury; also, because they are susceptible of any degree of tint, and of every shade of colour, for preparation of various imitations of precious, or as called, artificial stones, for tinging crystal, for enamelling, for painting porcelain and common earthenware, with pottery goods of every description; likewise, from its indispensable and essential use in painting,—the polite arts are much benefited,—also in varnishing; but to the painter, in particular, its utility is beyond every comparison, because there are certain natural objects which he could not imitate without having its assistance; such, for instance, as those

deep and velvet-coloured blues upon the wings of the peacock and butterfly,—that almost inimitable lustre on the growing plum, which a touch destroys, called its bloom,—the expanse of the firmament of heaven, &c.

The cheaper kind of this material is employed to keep our linen, cottons, &c. free from that disagreeable yellow tint which they acquire in process of time, whilst under the hands of the laundress.

The preparation of this colour must be reckoned among the most beneficial inventions of modern times, from the benefit society derives from its use and application, as well as from its affording utility to a heretofore useless mass of material. It likewise serves for another most valuable purpose, by furnishing employment for thousands of hands in the mining districts, who would probably be unemployed, and, of course, most likely need the common necessities of life.

There can scarcely exist a doubt that the process used for these various productions was invented about the latter part of the fourteenth or the beginning of the fifteenth century, although probability is greatly in favour of the ancients having discovered this valuable secret, or some equivalent, extracted from the womb of nature, from the perfection to which they brought their coloured glass: although it is said an iron preparation may imitate it; yet this does not seem fully proved. Glass, coloured, perhaps, with this material, cannot be shown in a more resplendent specimen than in that beautiful remain of antique art in the *British Museum*, denominated the *Barberini* or *Portland* vase, from its respective possessors; the beauty of which is very considerably enhanced by the colourless opaque engraving on its exterior surface; and which afforded the truly ingenious *Mr. Wedgwood* so excellent a specimen for his delicately beautiful imitations of this mode of relief. To digress one moment, we may be pardoned, when we know the universal attention of a tasteful public, which they evince in an uncommon degree of curiosity, to be informed of the subject matter of this composition. Many and ingenious are the result of various researches which have been made by learned antiquaries of Italy,¹ France,² and England,³ to ascertain the subject of representation; but it should appear, from the report of the trustees of that institution, that all such labours have been yet bestowed in vain. However,

¹ Count de Caylus, &c.

² Montfaucon, and others.

³ An almost infinite number of eminent names.

with the permission of the public, at some future period, we propose to endeavour to illustrate this hitherto hidden theme; and our subsequent cogitations all serve to confirm us in the truth of our first impression, in whatever way we view this subject.—But to return, the accident which has been presumed to have deprived the world of the benefit of the antique ingenuity of former times, in the production of that species of materials, now coloured by this substance; and its consequent knowledge has been attributed, by a most respectable writer, to the exhausted state of ancient mines. What degree of credit may attach to this conjecture, we are not qualified to determine. He, the writer, above alluded to, also rests his argument upon the more probable basis, for the loss which the world sustained from the dark meridian of European night since the destruction of the Roman empire; and before that period, in the manufacture of that metallic compound, known as *Corinthian brass*. He adds, “The use of cobalt does not,” even now, “imply a knowledge of its metal, for the moderns made brass and smalt for whole centuries, before they learned to prepare zinc, and regulus of cobalt.”⁴

The difficulty, however, to answer this, free from contingent objections, may be sufficiently obvious, as it appears cobalt is not found with any certainty of success among those metals known to the ancients; they not being able, in the infant state of their mineralogical knowledge, to describe the latent properties of metals; as we find they left us nothing on this head to discriminate, like as in salts, beyond their *generic* appearance.

To this position we conceive the public will concede, as they well know, that in no species of minerals, is there any thing more variable and uncertain than is the appearance of cobalt. At the time this shows the utter impossibility of distinguishing particular metals from general appearances, it serves to impress us with the belief of the intrinsic value of actual experiment; fire being the only true, the only certain criterion.

We do not assume to have read the ancients so extensively as numbers whose superior years and opportunities may have permitted, but from what we have seen, we recollect very few passages indeed, having relation to this metallic or mineral substance. Indeed, Mr. Professor *Beckmann*, whose Greek and Roman learning appears profound, and his industry infinite, says, there are scarcely *two*

passages in antiquity, relating to it, and these, he adds, on examination, afford very little information.

Aristotle, Theophrastus, Dioscorides, Pliny, and some few others, are all the writers of antiquity upon natural subjects, where such information could be expected to be found. Some of them speak of the term *cadmia*, but to moderns, its meaning must be as uncertain, as was the term *cobalt* two centuries ago. There is, however, room to conjecture that sometimes it denoted *calamine*; at others, signified *scoria* and common dross; whilst there is likewise room to suppose that in a third sense, it stood for *arsenic*: but, it appears, that it was never applied to cobalt⁵ until the modern mineralogists wished to find a Latin term for that substance; and it is thought the first of these who used that term was *Agricola*. And this term, it has been contended, does not belong to it.

A certain passage in *Pliny* has, however, been thought to describe it; while others have contended that that passage is so extremely diffuse and indefinite, that certainty cannot attach specifically to that substance. This, indeed, *Pliny* describes as a mineral pigment, producing different shades and degrees of blue paint, according as it was pounded, coarser or finer. The palest powder he calls *lomentum*; this colour *Lehmann* alleges to have been our powder-blue. It does not appear to have been yet agreed upon, whether or not the *cyanus* of *Theophrastus*,⁶ the *cœruleum* of *Pliny*,⁷ and the *chrysocolla* of *Aristotle*,⁸ were that blue copper earth, which has often been mentioned, and which may have been mixed and blended together. Likewise, *Pliny* adds to it an artificial colour which may have been made, it is thought, in the same manner as our *lac*; for he speaks of an earth, which when boiled with plants, acquired their blue colour, and which was also in some degree inflammable. This might have been from a saline and aluminous earth. With these pigments, we are told, walls were then painted; but as many of these colours would not endure lime, they were plastered of clay (*creta*). The expressson *usus ad fenestras*, *Lehmann* properly conceives to apply to painting window-frames, glass in windows being then unknown. Professor *Beckmann* thinks *Pliny* meant to say only that one kind of paint could not be employed near openings which afforded a passage to the light,

⁵ It will also presently appear this is the name it received on its original discovery.

⁶ *De Lapid.* p. 97.

⁷ *Lib.* xxviii. c. 13.

⁸ *Auscult. mirab.* p. 123.

as it soon decayed and lost its colour; which would have been the case with *lacs*, in which were mixed vegetable particles.

It really appears, that there are few traces found of cobalt in the writers of antiquity; the inference is, that had this substance then existed, it would have been mentioned;—whence, the conclusion appears, that it was not known to the learned ancients. There also appears another strong reason why they would have spoken of it: the arsenical particles so often found mixed with this mineral, must, of necessity, have rendered its use very dangerous. A third, and conclusive reason appears to have occurred to the learned Professor,—“Would not *arsenic* and *bismuth* have been sooner known,” had cobalt been separately taken notice of by the ancients? It is certainly a circumstance of moment, to observe, that in places where the ancients had mines, and where pieces of antiquity have been discovered, cobalt has not been found. Hence then the question is resolved into a simple affirmative or negative proposition; it appearing quite evident that the ancients must have possessed some pigment susceptible of standing the vitrifying action of fire, or how could they have formed their beautiful and confessed superior species of glass, mosaic, and other wares, exposed to the operation of that active element? They, we submit, must have employed for those purposes a mineral of some description; which, according to the conception of Mr. *Gmelin*, was prepared from iron, as previously suggested; and which he does not think sufficiently beautiful for the variety of shades and that rich appearance observed in antique productions, or they might have employed the efflorescence, rust, or scoria of copper; we know not, by-the-bye, whether this would produce a blue *from the fire*; but without heat, it yields a beautiful green. It may appear possible, that the intensity of the furnace would consume the ochereous particles, which are a component of the last mentioned colour, and so leave a mineral blue; but this not being certain to us, we cannot reason upon it.

It, to us, assuredly does appear that the ancients were well informed of the properties they employed in most things; for, had they been ignorant of their natures, they must have failed to afford such exquisite productions as we behold proceed from their confessed ingenuity; and, it is also evident, they were not so ignorant of metallurgy as is generally believed. The Egyptians, who go beyond both Rome and Greece, in point of time, as well as excellence in many arts, were in the earliest periods of their history

well conversant with the properties of most minerals their country yielded; and we have seen so did the Assyrians before either of them. Their glass, we have already seen in a former article, was greatly prized by the luxurious Romans; their enamel also,—and in brief, in all those arts where intense attention and profound application were necessary, they surpassed almost every other people.

From what we have seen, we must conclude that the ancients, Assyrians, Egyptians, Grecians, and Romans, were intimate with the properties of cobalt, although, perhaps, we have been stumbling over the appellation they assigned to it. The previous extract from Pliny appears to sanction this belief, from the circumstance of his specifying the various degrees of the same colour, which his celestial blue (*cæruleum*) produced.

As the subsequent observations may tend to confirm our opinion, or else to refute it: we state, that at the present moment we are not informed of the nature or properties of Egyptian, Arabian, Ethiopian, Italian, Chinese, or Cyprian cobalt; but we understand the mineral we now know by that name was first produced in Spain, in the reign of Philip IV. It has been indeed observed, that the island of Cyprus was formerly so abundant in copper, that the name *Venus* was assigned it, with singular propriety: whence, it is said, we cannot have room to doubt the nature of the *cæruleum Cyprium* of that island was a copper-blue: if so, it must have been produced as we have above surmised.

The basis on which *Lehmann*, *Du Pauw*,⁹ *Ferber*, and *Delaval*,¹⁰ ground their opinions that the ancients used *smalt*, and were well acquainted with *cobalt*, is, on account of the various antiquities we have of painting and *enamel*, which they allege was produced by this pigment. *Ferber*¹¹ speaks of blue glass squares in their mosaic-work; *Delaval* mentions old Egyptian glass of this colour. See also the mummy-cases in the *British Museum*. It is said to be well known that the Chinese and people of Japan gave to their porcelain that fine blue colour, for which it has been for ever famous, long before the discovery of smalt in Europe. We consulted the *Pseudodoxia Epidemica* of Dr. Brown, and find that he mentions the various opinions of *Guido*, *Pancirollus*, *Scaliger*, and *Ramuzius*,

⁹ Recherches philosophiques sur les Egyptiens et les Chinois, Berlin, 1773, i. p. 345.

¹⁰ An experimental Inquiry into the Cause of the Changes of Colour in opaque and coloured Bodies, by E. H. Delaval. London, 1774, 4to. p. 56.

¹¹ Briefe aus Welschland. Prag. 1773, 8vo. p. 114, 136, 223.

as to the material whereof the porcelain of China is manufactured; that of *Gonzales de Mendoza*, the Spanish ambassador from Philip II.; of *Odoardus Barbosa*, of *Lischotten*, the oriental navigator, and, as he says, a diligent inquirer; also, of *Alveraz*, the jesuit, who lived long in those parts. We have not room to give his information in detail, but sum it up in saying, he discovered that all these must give place to a later account, furnished by the Batavian embassy in 1665, whereby he was informed that in the stead of the idle tales of the former, collected from that jealous people, the earth whereof porcelain dishes are made, is brought from the mountain of *Hoang*, in square loaves, marked with the Emperor's seal. "The earth is very fine, clean, and shining like sand; and is prepared and fashioned after the same manner which the *Italians* observe in the fine earthen vessels of *Faventia*, or *Fuenca*; that they are so reserved concerning this artifice, that it is only revealed from father to son. That they are painted with *indigo*, (*indico*, as he says,) baked in a fire for fifteen days together, with very dry, but not smoking, wood." The author, when he saw the process, could not refrain from laughter at the common opinion entertained by those which our author had previously noticed and rejected.

It must occur to all who read this extract, that it is far from being correct: first, the jealousy of the Chinese prevents the process from being known even among their own people, except to those whose hereditary right it is to exercise this trade; yet the author of that relation saw it, being a stranger; and next, it is impossible it can be true that they use indigo in their blue colour, which being a vegetable preparation from the plant called *anil*, consequently could not stand the fire.

The fact is, that respecting China, the constitutional jealousy of that people prevents Europeans from satisfying a laudable curiosity in exploring the country, to know its produce. It is, we know, an extensive empire, the largest in Asia: why then, in the name of European partiality, may not the Chinese raise smalt or cobalt in their own territories, as the produce of the earth must be nearly uniform? The only idea which opposes this belief, appears in their purchasing large quantities of *this mineral* of the Europeans trading with them; for this, *tin*, and *scarlet shreds* are believed to be the chief of European imports into their country.¹² But

¹² As Von Strahlenberg informs us, that in Tartary there are two districts which yield the *lapis lazuli*, (i. e. the province of Dauria, near Arzun, which is very fine,

we should have excepted silver and gold, which they do not refuse in exchange for their productions, much to the detriment of civilized and liberal Europeans. And, since the *anana* was not cultivated in Europe till after a great variety of unsuccessful attempts, when, at length, Baron *Munchausen* of celebrated memory, procured that delicate plant to flourish in his garden at *Schwobber*, in *Hanover*, subsequent to 1714, after most of the luxurious in Europe had made repeated and ineffectual trials to obtain it on the continent and in this country: in both it is now cultivated with success;—it had been sought from 1474, a period of 240 years! Surely *tea*, which is a hardier plant than the *pine-apple*, might, with attention, be cultivated in Europe. The indefatigable and patriotic *Linnaeus* also thought so. The attempt would be certainly worth the experiment.

It has been asserted, but it appears without any probability of truth, that China dishes were buried for a century beneath the surface of the earth. Now, our literary acquaintance, the learned Professor Beckmann says, he has often observed, and it has been remarked to him by others, that the azure colour of new Chinese porcelain is not so beautiful as the old. The fanciful idea of imitation may be, perhaps, here applied to advantage, if we *could* but believe, that on this article time produces quite a different effect to what is observed upon most other objects within our knowledge. The same opinion, could it be effectually ascertained, would help the Professor to remove a distrust in his opinion, respecting the real antiquity of the use of cobalt in the glass and enamel of the ancients.

With respect to the name *cobalt*, it should appear it was first adopted by Mathesius and Agricola; who used it in their writings. Frisch is said to have derived it from the Bohemian word *kow*, which signifies *metal*; but the conjecture that it was formed from the word *cobalus*, the name given to a spirit, which, according to the superstitious notions of those times haunted mines, destroyed the labours of the workmen, and occasioned much trouble, is more probable; there is reason to think that this last was borrowed from the Greek. It is supposed the miners gave this name out of joke, as this mineral often deceived them.

We now come to speak of the modern discovery of

and, likewise, at Kongur, a more ordinary species), it really appears to us probable that, instead of cobalt, the Chinese use the former substance in painting their china. The Russians constantly hold a trade with the Chinese, by caravans, which are employed about six years on their journey.

this pigment, as applicable to the arts. The first mention that has been perceived of it, occurs in some papers, the information of *Klotzsch*, which he first published from those papers of *Christian Lehmann* we have had occasion to notice. *Klotzsch* was, as we understand, the author of an historical work, respecting the mines in *Misnia*, as well as a clergyman at *Scheibenberg*; he had collected the materials for his historical work with great industry, embracing every degree of information with respect to the natural history of the neighbouring country. He died at an advanced age, in 1688. From his account, at the period he wrote, the colour-mills were an hundred years old. He commenced writing his narrative towards the end of the thirty years' war; whence, it is computed those were first erected about 1540 or 1560. The circumstance is related as follows, as given by Professor Beckmann; "*Christopher Schurer*, a glass-maker at *Platten*, a place which belongs still to Bohemia, retired to *Neudeck*, where he established his business. Being once at *Schneeberg*, he collected some of the beautiful coloured pieces of cobalt which were found there, tried them in his furnace; and finding that they melted, he mixed some cobalt with the vitreous mass, and obtained fine blue glass. At first he prepared it only for the use of the potters; but in the course of time it was carried as an article of merchandize to *Nuremberg*, and thence to *Holland*. As painting on glass was then much cultivated in the latter, the artists there knew better how to appreciate this invention. Some Dutchmen therefore repaired to *Neudeck*, in order that they might learn the process used in preparing this new paint. By great promises they persuaded the inventor to remove to *Magdeburg*, where he also made glass from the cobalt of *Schneeberg*; but he again returned to his former residence, where he constructed a hand-mill to grind his glass, and afterwards erected one driven by water. At that period the colour was worth seven dollars and a half per cwt. and in *Holland* from fifty to sixty florins. Eight colour-mills of the same kind, for which roasted cobalt was procured in casks from *Schneeberg*, were soon constructed in *Holland*; and it appears that the Dutch must have been much better acquainted with the art of preparing, and particularly with that of grinding it, than the Saxons; for the Elector, *John George*, sent for two colour-makers from *Holland*, and gave a thousand florins towards enabling them to improve the art. He was induced to make this advance chiefly by a remark of the people of *Schneeberg*,

that the part of the cobalt which dropped down while it was roasting, contained more colour than the roasted cobalt itself. In a little time other colour-mills were erected around Schneeberg. Hans Burghard, a merchant and chamberlain of Schneeberg, built one, by which the eleven mills at Platten were much injured. Paul Nordhoff, a Frieslander, a man of great ingenuity, who lived at the Zwittermill, made a great many experiments in order to improve the colour, by which he was reduced to so much poverty that he was at length forced to abandon that place, where he had been employed for ten years in the colour-manufactory. He retired to Annaberg, established there in 1649, by the assistance of a merchant at Leipsic, a colour-manufactory, of which he was appointed the director; and by these means rendered the Annaberg cobalt of utility. The consumption of this article, however, must have decreased in the course of time; for in the year 1659, when there were mills of the same kind at more of the towns in the neighbourhood of mines, he had on hand above 8000 quintals."—*Lehmann*.

Christian Melzer, in *Berglaufftige Beschreibung der Stadt Schneeberg*, 1684, 4to. p. 405, informs his readers, that the mines of Schneeberg, which were first discovered in the middle of the fifteenth century, had so much declined towards the middle of the sixteenth century, that it was impossible to get any profit by them till about 1550, when a greater advantage arose from the new method of using cobalt; about which period a contract was entered into with the Dutch, who agreed to take the roasted cobalt at a certain price. *Lehmann*, who does not adduce any proofs for his assertion, where he says, a manufactory for blue glass was erected by Sebastian Preussler, between Platten and Eybenstock, so early as 1571. *Rosler*,¹³ who died in 1673, in the seventy-sixth year of his age, gives us to understand that a century and a half before his time, cobalt was procured and sold as *zaffer*; but that the colour-mills in that country had been established only about sixty years. It is probable roasted cobalt, to which sand was added to conceal its nature, and render the further preparation of it more difficult, was acquired by the Dutch as early as the commencement of the sixteenth century; and these people, by melting it anew, or perhaps, pounding it finer, derived great benefit from it long before the Saxons themselves constructed machinery for reducing it to powder, according

¹³ *Speculum metallurgiæ politissimum*. Dresden, 1700, fol. p. 165.

to the mode of those in Holland. Even at present, it is said, many of the Dutch grind German cobalt with much advantage.

It should seem that *Agricola* was not acquainted with blue glass; but it is, perhaps, strange that neither he or *Mathesius*, mention *zaffera*. *Albin*, who derived his chief intelligence from these two authors, is also silent on this subject: but observes of *bismuth*, when put in vessels it grew together again. It should seem, however, he alludes to roasted cobalt when mixed with sand, as it assumes a compact appearance. For bismuth, when it is purified by roasting, can never attain that state. *Vannuccio Biringoccio*, who flourished in 1725, describes *zaffera* as a material used for painting glass; he calls it a heavy mineral without any further definition. *Cardan* gives the name *zaffera* to an earth which colours glass blue. *Julius Scaliger*, in his *Exercitationes* on *Cardan*, mentions nothing of moment concerning it. *Porta*, who employed great diligence to obtain this species of knowledge, often mentions *zaphara figlinorum*, without saying what it is; but he describes it as being useful in giving the tint to artificial stones, after being reduced to fine powder, sifted, washed, &c.

It appears, the first writer who properly described cobalt, and furnished a correct idea of its preparation, according to *Beckmann's* opinion, was *Kunkel*, in his *Glasmacherkunst*, Nuremberg, 1743, being annotations on what *Neri* and *Merret* had said before him; he describes *zaffer* thus; saying the miners call it *zafloer*, and that sand was mixed only for the purpose that the powder-blue used by women, for linen, and smalt used by painters, might not be spuriously imitated in other countries. *Rosler* also says, the Bohemian cobalt is not so good as that of *Misnia*, its colour being more like ashes. Also *Brandt*, a member of the Council of Mines in *Sweden*, first asserted that cobalt contained a semi-metal of a peculiar description. About the end of the fifteenth century, cobalt was first discovered by the miners on the confines of Saxony and Bohemia. But it had been found in Spain previous to that period, as we have seen. But in Germany, it is said to have obtained its name from *Cobalus*, the name of the evil genii of mines, for the reason before given: it was, besides, prejudicial to their health, from the particles of arsenic contained therein. It is observed, that so much were the clergy slaves to the popular superstition of the times, that they offered up a form of prayer for the protection of the miners against *kobolts*, spirits, &c.

COACHES.

Etymology.—Coach is said to be derived from *coche*, *caroche*, or *carosse*: these come from *caroccio*, Italian; a term first used in the eleventh century, and invented to designate a military machine, so called; but was adopted from *caretta*, Italian, or from, perhaps, *kitsee*, Hungarian,¹ signifying a large car or military waggon.

Etymologists, and among them appears a man of considerable erudition and infinite industry, whom we much respect, have puzzled themselves to discover an original for this name, which Dr. *Rees* has helped us to, and which is previously (fortunately) given; but it has been defined by *Joh. Ihre*, in his *Glossarium Sueogothic*, to come from *kusk*, which implies, we understand, a coachman, rather than the vehicle itself. Gall. *cocher*; Hisp. idem. Ital. *cocchio*; Ang. *coach*; Hungary, *cotezy*; Belg. *goetse*; German, *kutsche*. The driver of such a carriage is called in English coachman; in other languages it is made shorter, the French say *cocher*, the Germans say *kusk*. Menage derives the name from a Latin original, far to be sure does he travel for it, making it come from *vehiculum*. Junius comes somewhat nearer when he says it is from the Greek *ὄχεω*, to carry. Wachter conceives it comes from the German word *kutten*, to cover; whilst Lye says it comes from the Belgic, *koetsen*, to lie along, properly signifying a couch or chair. Eventually, however, he conceives he has found it in what M. Cornides has advanced, who says it is of Hungarian extraction, that it came from a village called *Kitsee*, in the province of Wieselburg. But upon the proof previously given, the public, we think, may rely; thence it is we find of ITALIAN extraction.

Musatori, in his dissertation on the rude age of Italy, (vol. i. p. 360,) observes, that the inventor of the *caroche*, introduced after the year 1000, was *Egbert*, Archbishop of *Milan*, in the eleventh century, who directed a standard of the following form should be made for his men when engaged in battle. “ A tall beam, like the mast

¹ In David Czvitinger's *Specimen Hungariæ Litteratæ*, Frank. et Leipz. 1711, 4to. there is an account of the service rendered to the arts and sciences by Hungarians, but no mention occurs of coaches. The ancient English term for this vehicle was *whirlicote*.

“ of a ship, fixed in a strong waggon, raised on high,
 “ bearing on the top a little golden ball, with two very
 “ white streamers depending from it; in the middle, the
 “ holy cross, painted with the image of our Saviour, with
 “ its arms widely spread, overlooked the surrounding troops.
 “ So that whatever should be the event of the contest, they
 “ might be comforted with this sign. This afterwards was
 “ assumed anciently by the Milanese, with other Italian
 “ states, as the Bolognese, Panetians, Veronese, Beris-
 “ cians, Cremoners, Placentians, Parnassians, &c. and
 “ afterwards, that is, in the thirteenth century, the use of
 “ the caroché was regarded as peculiarly advantageous in
 “ conquering the enemy. To preserve it was considered
 “ honourable, and to lose it the greatest disgrace.”

Coaches.—We intend this word to stand for the generic name of all those machines used for the carriage of persons on business or pleasure; except, indeed, those for the conveyance of the dead; from the state carriage of the sovereign down to the humble gig. The original inventor of this species of carriage, is said to have been an Athenian monarch, and to the best of our recollection, Erichthonius, the fourth Athenian king, B.C. 1489, who, being afflicted with lameness in his feet, first invented a coach for his convenience, and with a view to conceal that defect. This may be regarded as the first original of the kind of Grecian invention.

Diodorus Siculus, indeed, makes mention of a carriage in which Sesostris was wont to be drawn; and also, he says, when he entered the city or went out to the sacrifice, had four of his captive kings yoked to his chariot; but it is conjectured this carriage, to which that historian alludes, was a warrior's car. There is, most assuredly, ample room to believe that this was the first species of carriage which was introduced; if so, those existed long before the Athenian king above named; because all the Homeric heroes, Greeks as well as Trojans, and their auxiliaries,² rode in these machines, called chariots or warrior's cars, which are also known to have existed long antecedent even to that period; for they are repeatedly mentioned and expressly described by *Diodorus Siculus*, as well as scythe cars, used in the vast armies which the Assyrian princes raised; *Ninus*, *Semiramis*, the

² See the instance of Achilles' carriage and horses, that of Machaon, &c. Hector, and last Rhesus, to which this note has particular reference, in the xth *Iliad*, l. 499.

Bactrian, Indian, and Persian monarchs, all used them. Indeed, he expressly says, in his second book, chapter the first, that Ninus employed "no fewer than 10,600 hooked chariots" in his expedition against the Bactrians. The total of his armed men consisting of the immense number of 411,800.

In the same chapter, he subsequently relates, from *Ctesias*, it is true, that *Semiramis* had in her army against Porus, the Indian king, "a hundred thousand chariots; that her whole force on this expedition, amounted to three millions six hundred thousand of effective men."

To specify no more instances, we may remain assured that war chariots were used in the first ages of the world by all the great monarchs who possessed dominion. As the form of this chariot is so often described in *basso* and *alto rilievo* representations, no description from us may be necessary to aid public conception.

That species of carriage before said to have been invented by the Athenian, we therefore presume was a covered carriage, similar to that species designated in the twelve tables of the Roman law, and by them called *arcera*, which was said to be a carriage of the last presumed description, and mentioned as being intended for the conveyance of the infirm.³ To this species of carriage, we are told, succeeded the soft *lectica*, which brought the *arcera* into disuse.

A still later invention of the Romans was the *carpentum*; its form may be often seen on ancient coins and medals, a two-wheeled car, with a covering, generally formed of rich cloth.⁴ Still later were introduced the *carruca*, first mentioned by *Pliny*; but as that author did not particularise the description, antiquaries are not agreed in their opinion, whether it was a carriage with only one wheel, like our wheel-barrows, or whether it had four wheels;⁵ this last is thought to be the most probable opinion; but, be it as it may, there is but little room to doubt that they were considered as first rate vehicles; when we are assured they were often adorned with gold and precious stones; and that the Romans considered it as an honour to ride in them that

³ *Arcera* vocabatur plastrum tectum undique et munitum, quasi arca quædam magna vestimentis instrata, qua nimis ægri aut senes portari cubantes solebant. See *Leges XII. tabularum illustratæ* a J. N. Funccio. Rintelii, 1744, 4to. p. 72. Gellius, xx. 1.

⁴ Scheffer de re vehiculari, in *Utriusque thesauri antiquitatum nova supplementa* congesta a Poleno. Venetiis, 1737, fol. v. p. 1380. Spanhem. de præstant. numismatum. Amst. 1671, 4to. p. 613. Propertius, iv. 8, 23, mentions *serica carpenta*.

⁵ Scheffer, l. c. p. 1472.

were remarkably high. In the Theodosian code the use of them is not only allowed to civil and military officers of the first rank, but commanded as a mark of their dignity.

However, after the destruction of this once virtuous people, when they had eventually become the slaves of lust and vicious propensities, as the state acquired riches and power, their character became radically changed; but after the total demolition of their empire of the world, a change of masters brought with it a complete alteration in the moral manners of this people, and others, the dependents of their supreme authority. The northern sovereigns speedily introduced new customs, conformable to the rudeness of their savage education, and selfish as was their views. Carriages generally now became disused, they had no idea of encouraging the growth of luxury and supinuity when they wanted vigorous subjects,—men fit to fight their battles and to endure the toils of a camp. Accordingly, those who used to ride in carriages, now became equestrians, both men and women, clergy and laity, courtiers and clowns, all rode on horseback. Such is the influence of example in our superiors, who can mould dependents and inferiors into whatever shape they please. At least such was the revolution in the moral habits of Europeans, upon the subjugation of that once mighty empire.

But, perhaps, we had better collect from particular instances, than to detail our own conceptions in general expression. Accordingly, we find, that after the subversion of Roman power, the northern sovereigns, who had become the barbarous and ignorant oppressors of our species, introduced and established, among other political regulations, the feudal system, as it was called, by which all property in land was held by certain fiefs, whereby the king, or, as termed, lord of the soil, let certain proportions of the land to his nobles, military officers, and other great persons, and generally, often on condition of certain services required to be performed, called *socage* or *soccage*, *knights'-service*, and other military tenures; by which custom, those tenants of the sovereign had to provide certain men and horses to serve them in their wars. These first tenants, or vassals, afterwards underlet those lands to villains, so named, in contradistinction to the present recognised term, from their living in villages or hamlets, and other tenants, from whom, in their turn, similar services and certain provisions were required: thus the European world, which had become the prey of effeminacy and *Caprean* luxury, had, by this single important circumstance, their character so completely, so effectually, so radically changed,

that, like the mysterious power of the Cadmæan wand of harlequin, wrought so uncommon a change in the moral habits of European society, that those who had formerly kept carriages, and wallowed in all the soft luxurious delicacy of Asiatic effeminacy, suddenly, or, at least, progressively, became a society of hardy equestrian veterans. In-somuch, that masters and servants, husbands and wives, clergy and laity, all rode upon horses, mules, or asses: which latter animals were chiefly used by women, monks, and other religious. The minister rode to court; the horse, without a conductor, returned to his stable, till a servant, regulated by the *horologe*, took him back to the court for his master.⁶ In this manner, we are assured, the magistrates of the imperial cities rode to council, till as late as the beginning of the fourteenth century; so that, in the year 1502, steps to assist in mounting were erected by the Roman gate at Frankfort.⁷ The members of the council, who at the diet, and on other occasions, were employed as ambassadors, were, on this account, called *rittmeister*, in the language of the country; at present the expression *riding servant* is preserved in some of the imperial cities. The entry of great lords in public into any place, or their departure from it, was never in a carriage, but always on horseback; in all the pontifical records, speaking of ceremonials, no mention is made either of a state coach or body coachman; but of state horses, and state mules. In the following regulation it is found, that the horse which his Holiness rode, “was necessary
“ to be of an iron-grey colour; not mettlesome, but a quiet
“ tractable nag. That a stool of three steps should be pro-
“ vided for the assistance of his Holiness in mounting: that
“ the Emperor or Kings, if present, were obliged to hold
“ his stirrup, and lead the horse.”⁸

Bishops made their public entry, on induction, on horses or asses, richly caparisoned.⁹ At the coronation of the emperor, the electors and principal officers of the empire were ordered to make their entry on horseback.¹⁰ It was formerly

⁶ C. A. Geutebruck, Gedanken und anmerkungen über die einrichtung einer kammer-verwaltung. Erfurt, 1765, 8vo. p. 11.

⁷ Lersner, Chronica der Stadt Frankfurt, i. p. 23.

⁸ Sacrarum cæremoniarum Romanæ ecclesiæ libri tres, auctore J. Catalano. Romæ, 1750, 2 vol. fol. i. p. 131

⁹ See J. P. Ludewigs Gelehrte anzeigen, welche vormals den Wöchentlichen Hallischen Anzeigen einverleibt worden, nunmehr aber zusammen gedruckt. Halle, 1743, 3 vol. 4to. i. p. 426, where the following passage is quoted from *Ceremoniale Episcoporum*, lib. i. c. 11. Episcopus ascendet mulam ornatam pontificalibus ephippiis et stragula violacei coloris, ac ita equitabit.

¹⁰ Ludewigs Erläuter. der Gùlden Bullen. Frank. 1719, 2 vol. 4to. i. p. 569.

requisite, that those who received a fief, or other investiture, should make their appearance on horseback. The vassal was obliged to ride with two attendants to the court of his lord, where, after he had dismounted his horse, he received his fief.

Covered carriages were again known in the beginning of the sixteenth century for women of the very first rank; the men thought it *disgraceful* to ride in them. At that period, when the electors and other Germanic princes did not choose to be present at the meetings of the states, they excused themselves, by informing the Emperor, that their health would not permit them to ride on *horseback*; which was considered as an *established point*, that it was unbecoming in them to ride like women. What, according to the then prevailing ideas, was not permitted to princes, was much less allowed to their servants. In anno 1544, when Count Wolf, of Barby, was summoned by John Frederic, Elector of Saxony, to go to Spires to attend the convention of the states assembled there, he *requested leave*, on account of ill health, to make use of a close carriage with four horses. When the counts and nobility were invited to attend the marriage solemnity of the elector's half brother, John Ernest, the invitation was accompanied with a memorandum, that such dresses of ceremony as they might be desirous of taking with them, should be transported in a small waggon. Which notice would have been unnecessary had coaches been generally used among those nobles. The use of covered carriages was, for a long time, forbidden even to women, the consorts of princes. About anno 1545, the wife of a certain duke obtained from him, with great difficulty, permission to use a covered carriage in a journey to the baths, in which permission there was, however, this express stipulation, that none of her attendants were to be permitted this indulgence; though much pomp was displayed upon this occasion by the duchess, as *Beckmann* informs us, from Sattler's *Historischer Beschreibung des Herzogthums Württemberg, im ersten theile, bey erläuterung einer urkunde vom jahr, 1389*.

Notwithstanding, about the end of the fifteenth century, emperors, kings, and princes began to employ covered carriages in journeys, and afterwards on public solemnities. When Richard II. towards the close of the fourteenth century, was compelled to fly from his rebellious subjects, himself with all his followers were on horseback; but his mother, who was weak and sick, rode in a carriage. But this became afterwards unfashionable here, for that monarch's

queen, Anne, daughter of the King of Bohemia, showed the English ladies how gracefully she could ride on a side-saddle; and, therefore, whirlicotes and chariots were disused in England, except on coronations and other public solemnities.

In the year 1471, after the battle of *Tewkesbury*, which decided the fate of Henry VI. and that of the house of Lancaster, when others flew in different directions, the Queen was found in her coach almost dead with sorrow.—*Hall's Chron.*

In 1474, the Emperor Frederick III. came to Frankfort in a close carriage; and as he remained in it on account of the wetness of the weather, the inhabitants had no occasion to support the canopy which was to have been held over him, but while he went to the council-house and returned. In the following year, the same Emperor visited that city in a very magnificent carriage. In 1487, on occasion of the celebration of the feast of St. George at Windsor, in the third year of Henry VII. the Queen and King went in a rich chaise; they were attended by twenty-one ladies, who rode upon palfreys richly caparisoned. (*Ashmole's Order of the Garter.*) In the description of the splendid tournament held by *Joachim*, Elector of Brandenburg, at Ruppin, in 1509, *Beckmann* says, he reads of a carriage all gilt which belonged to the Electress; of twelve other coaches, ornamented with crimson; and of another of the Duchess of Mecklenburg, which was hung with red satin.

In the Northumberland household-book, about this period, is an order of the Duke for the chapel stuff to be sent before in my lord's chariot.

At the coronation of the Emperor Maximilian, in the year 1562, the Elector of Cologne had twelve carriages. In 1594, when the Margrave John Sigismund did homage at Warsaw for Prussia, he had in his train thirty-six coaches with six horses each.¹¹ Count *Kevenhiller*, speaking of the marriage of the Emperor Ferdinand II. with a Princess of Bavaria, says, "The bride rode with her sisters in a splendid carriage studded with gold; her maids of honour in carriages hung with black satin, and the rest of the ladies in neat leather carriages." The same author mentions the entrance of Cardinal Dietrichstein into Vienna, in 1611, where he tells us that forty carriages went to meet him.¹²

¹¹ Suite des Mémoires pour servir à l'Hist. de Brandenburg, p. 63; where the royal author adds, "The common use of carriages is not older than the time of John Sigismund." He also remarks, that those carriages were coarse coaches, composed of four boards put together in a clumsy manner.

¹² Annal. Ferdin. V. p. 2199; and vii. p. 375. Von Mosers Teutsches hofrecht. Franc. and Leipsic, 1755, 4to. ii. p. 338.

At the election of the Emperor Matthias, the Ambassador of Brandenburg had three coaches. When the consort of that Emperor made her public entrance, on her marriage in 1611, she rode in a carriage covered with perfumed leather.

Mary, Infanta of Spain, spouse of the Emperor Ferdinand III. rode, in *Carinthia*, in 1631, in a glass carriage, in which no more than two persons could sit.¹³ The wedding carriage of the first wife of the Emperor Leopold, who was a Spanish princess, cost with the harness 38,000 florins.¹⁴ The coaches used by that Emperor are thus described by Rink: “ In the imperial coaches no great magnificence was to be seen: they were covered over with red cloth and black nails. The harness was black, and in the whole work there was no gold. The pannels were of glass, and on this account they were called the imperial glass coaches. On festivals the harness was ornamented with red silk fringes. The imperial coaches were distinguished only by their having leather traces; but the ladies in the imperial suite were obliged to be content to be conveyed in carriages the traces of which were made of ropes. At the magnificent court of Duke Ernest Augustus, at Hanover, there were, in 1681, fifty gilt coaches with six horses each.¹⁵ So early did Hanover begin to surpass other cities in the number of its carriages. The first time that ambassadors appeared in coaches, on a public solemnity, was at the imperial commission held at Erfurth, in 1613, respecting the affair of Juliers.¹⁶

Towards the end of the sixteenth century, (according to *Rees's Cyclopædia*, article *Coach*,) John of Finland, on his return from England, among other articles of luxury, brought with him to Sweden the first coach. Before that period, the lords of Sweden, when they travelled by land, carried their wives with them on horseback, and the princesses travelled in the same manner.

Beckmann also informs us, that the great lords of Germany first imagined that they could suppress the use of coaches by prohibitions. In the archives of the county of Mark there is still preserved an edict, in which the feudal nobility and vassals are forbidden the use of coaches, under pain of incurring the punishment of felony.¹⁷ In the year 1588,

¹³ Kevenhillier, xi. p. 1503.

¹⁴ Rink, *Leben K. Leopold*, p. 607.

¹⁵ Lünigs *Theatr. cer.* i. p. 239.

¹⁶ Ludolf, *Electa juris publici*, v. p. 416. Von Mosers *Hofrecht*, ii. p. 337.

¹⁷ Ludewigs *Gelehrte Anzeigen*, i. p. 426.

Duke Julius of Brunswick published an order, couched in very expressive terms, by which his vassals were forbidden to ride in carriages. This curious document is in substance as follows:—“ As we know from ancient historians, from
 “ the annals of heroic, honourable, and glorious achieve-
 “ ments, and even by our own experience, that the respec-
 “ table, steady, courageous, and spirited Germans were,
 “ heretofore, so much celebrated among all nations, on
 “ account of their manly virtue, sincerity, boldness, honesty,
 “ and resolution, that their assistance was courted in war,
 “ and that, in particular, the people of this land, by their
 “ discipline and intrepidity, both within and without the
 “ kingdom, acquired so much celebrity, that foreign nations
 “ readily united with them: we have, for some time past,
 “ found, with great pain and uneasiness, that their useful
 “ discipline and skill in riding, in our electorate, county,
 “ and lordship, have not only visibly declined, but have
 “ been almost lost (and, no doubt, other electors and princes
 “ have experienced the same among their nobility:) and as
 “ the principal cause of this is that our vassals, servants,
 “ and kinsmen, without distinction, young and old, have
 “ dared to give themselves up to indolence and to riding in
 “ coaches, and that few of them provide themselves with
 “ well-equipped riding horses, and with skilful experienced
 “ servants, and boys acquainted with the roads: not being
 “ able to suffer, any longer, this neglect, and being desirous
 “ to revive the ancient Brunswick mode of riding, handed
 “ down and bequeathed to us by our forefathers, we hereby
 “ will and command, that all and each of our before-men-
 “ tioned vassals, servants, and kinsmen, of whatever rank
 “ or condition, shall always keep in readiness as many
 “ riding horses as they are obliged to serve us with by their
 “ fief, or alliance; and shall have in their service able, ex-
 “ perience servants, acquainted with the roads; and that
 “ they shall have as many horses as possible, with polished
 “ steel furniture, and with saddles proper for carrying the
 “ necessary arms and accoutrements, so that they may ap-
 “ pear with them when necessity requires. We also will
 “ and command our before-mentioned vassals and servants
 “ to take notice, that when we order them to assemble,
 “ either all together, or in part, in times of turbulence, or
 “ to receive their fiefs, or when on other occasions they visit
 “ our court, they shall not travel or appear in coaches, but
 “ on their riding horses, &c.”¹⁸

¹⁸ Lünig. Corp. Jur. Feud. Germ. ii. p. 1447.

Philip II. Duke of Pomerania-Stettin, reminded his vassals also, in 1608, that they ought not to make so much use of carriages as of horses.¹⁹ All these orders and admonitions, however, were of no avail, and coaches became common all over Germany.

Professor Beckmann was at Bremen, in Oct. 1785, and in the Tax-chamber of the Senate-house of that city, he saw painted on a wall in oil colours, by John Landwehr, in 1661, a view of that city. On the left side of the fore-ground, he observed a long quadrangular carriage, which did not appear to be suspended by leather straps. It was covered with a canopy supported by four pillars, but had no curtain, so that one could see all the persons who were in it. In the side there was a small door, and before there seemed to be a low seat, or perhaps a box. The coachman sat upon one of the horses. It was evident, from their dress, that the persons in it were burgomasters.

Persons of the first rank, ladies we presume, in France, frequently sat behind their equerry, and the horse was often led by servants. When Charles VI. wished to see incognito the entry of the Queen, he placed himself on horseback behind Savoisy, who was his confidant, with whom, however, he was much incommoded in the crowd.²⁰ When Louis, Duke of Orleans, that Prince's brother, was assassinated in 1407, the two *ecuyers* who accompanied him, rode on horseback both upon one horse.²¹ In the year 1534, Queen Eleonora and the princesses rode on white horses (*des haquenées blanches*) at the time of a sacred festival. Private persons, in France, physicians for instance, used no carriages in the fifteenth century, which is proved by the principal entrance to their public school, erected 1472, which is built so very narrow as not to admit of a carriage passing through it.²² In Paris also, at all the palaces and public buildings, there were steps for mounting on horseback, such as those which the parliament caused to be erected in 1599; and Sauval says, on that occasion, that though many of these steps in latter periods had been taken away, there still remained several of them in his time at old buildings.

¹⁹ An attempt was made also to prevent the use of coaches by a law, in Hungary, in 1523. The words are: Et quod nobiles unius sessionis per singula capita pariter insurgere et advenire teneantur; et non in *Kotsi*, prout plerique solent, sed exercitantium more, vel equites, vel pedites, ut pugnare possint, venire sint obligati. Schwarz, *Pommerschen lehen-historie*, p. 497.

²⁰ Histoire des Antiquités de Paris, par Sauval, i. p. 187.

²¹ Sauval; also, Abregé Chronologique de l'Histoire de France, par M. de Mezeray. Amst. 1696, 3 vol. 12mo. iii. p. 167.

²² Variétés Historiques, Physiques et Littéraires. Paris, 1752, 3 vol. 12mo. ii. p. 87.

Carriages, notwithstanding, appear to have been used very early in France, as appears by an ordinance of Philip the Fair, issued in 1294, for suppressing luxury, and in which the citizens' wives were forbidden to use carriages, which is still preserved.²³ Under Francis I. or rather say about 1550, there were at Paris, for the first time, only three coaches; one of which belonged to the Queen; another to Diana of Poitiers, the mistress of two kings, Francis I. and Henry II. by the latter of whom she was created *Duchess de Valentinois*; and the third to René de Laval, Lord of Bois-dauphin, a corpulent nobleman, unable to ride on horseback.²⁴ Others say, that the three first coaches belonged to Catherine de Medici; Diana, Duchess of Angoulême, the natural daughter of Henry II. who died in 1619, in the eightieth year of her age; and Christopher de Thou, first president of the parliament. The last was excused by the gout; but the rest of the ministers of state soon followed his example.²⁵ Henry IV. was assassinated in a coach; but he usually rode through the streets of Paris on horseback; and to provide against rain, usually carried a large cloak behind him. For himself and his Queen he had only one coach; as appears by a letter still preserved, where he writes to a friend. "I cannot *wait* upon you to-day, because my wife is using my coach."²⁶ However, we find two coaches at the public solemnity on the arrival of the Spanish ambassador, Don Peter de Toledo, under the same monarch.²⁷ This contradiction does scarce deserve the remark, that it is believed all writers do not speak of the same species of carriage; besides, it is possible, that monarch might have increased his travelling establishment at this last mentioned period. Every kind of improvement, as remarked by Beckmann, affords an important epoch in their history.

²³ The author of the last-quoted work says, C'est une ordonnance de Philip le bel, de l'an 1292, qui est à la chambre des comptes au folio 44 d'un petit livre, lequel contient les ordonnances faites par Saint Louis pour la tranquillité du royaume; et qui se trouve aussi dans le registre noir du Chatelet de Paris; elle est même rapportée dans les notes et observations de la Thaumassiere sur les coutumes de Beauvoisis, p. 371. Cette ordonnance est intitulée, *L'Ordonnance que le Roi Philippe le Bel a fait faire des Superfluités oster de toutes Personnes, l'an 1294.* Le premier article est conçu en ces termes: *Premierement, nulle bourgeoise n'aura char.* This ordonnance is to be found also in *Traité de la Police, par De la Mare*, i. p. 418.

²⁴ Variétés Histor. p. 92.

²⁵ Valesiana. Paris, 1695, 12mo. p. 35.

²⁶ Variétés Histor. p. 96.

²⁷ Sauval says, I shall here remark, that this was the *first* time coaches were used for that ceremony, (the entrance of ambassadors,) and that it was only at this period they were invented, and began to be used.

Roubo, in his costly treatise on joiners' work, has furnished three figures of (*chars*) carriages used in the time of Henry IV. from drawings preserved in the King's library: from them, it is seen, those coaches were not suspended by straps, that they had a canopy supported by ornamented pillars, and that the whole body was surrounded by curtains of stuff or leather, which could be drawn up. The coach in which Louis XIV. made his public entrance, about the middle of the seventeenth century, appears, from a drawing in the King's library, to have been a suspended carriage.

Our national chronicler, John Stow, says, coaches were first known in England about 1580; he says, they were first imported from Germany, by Fitz-Allen, Earl of Arundel, in 1589, (Survey of London, 1633, fol. p. 70.) Anderson places the period, when coaches began to be used in common here, about 1605. It is remarked of the Duke of Buckingham, that he was the first who was drawn by six horses, in 1619. To ridicule this pomp, the Earl of Northumberland put eight horses to his carriage.

Towards the close of the thirteenth century, when Charles of Anjou made his entrance into Naples, the Queen rode in a carriage, called by memorialists *caretta*, the outside and inside of which were covered with sky-blue velvet, interspersed with golden lilies; a magnificence never before seen by the Neapolitans.

At the entrance of Frederic II. into Padua, in the year 1239, it appears there were no carriages, for the most elegantly dressed ladies who came to meet him were on palfreys, ornamented with trappings, (*sedentes in phaleratis et ambulanti bus palafredis.*) It is well known that the luxury of carriages spread from Naples all over Italy.

Coaches were seen, for the first time, in Spain in the year 1546, according to Twiss, who does not, however, vouch any authority.

It is said, there were elegant coaches in the capital of Russia so early as the beginning of the seventeenth century.²⁸

The *Berlin*, a species of coach so called, was introduced anterior to 1673, by Philip de Chiese, a native of Piedmont, a quarter-master and colonel in the service of Frederic William, Elector of Brandenburg, much esteemed by that Prince for his knowledge in architecture, who caused that carriage to be built for a journey which he made into

²⁸ Essai sur la Bibliotheque de l'Academie des Sciences de S. Petersburg, par J. Bacmeister, 1776, 8vo. p. 38.

France in the service of his Prince; he died at Berlin, 1673. *Vis-à-vis*, an open carriage, chiefly constructed for the benefit of conversation, as its name implies. *Landaus*, *landaulets*, *phaetons*, *chaises*, *whiskeys*, *gigs*, *fiacres*, &c. &c. are but names adapted to different purposes, and constructed nearly upon the same principles as coaches, but some of them covered, others open, and some to be opened or shut according to the weather, or other circumstances, and calculated to contain an indefinite number, from two to six persons; nay, there are public double coaches now employed on the Bath road, calculated to hold twelve persons inside, and as many on the outside.

The number of hackney-coaches employed, or rather which ply, in the streets of London, have been augmented, from time to time, since their first establishment; in 1625, when there were twenty; in 1637, fifty; in 1654, 300; since that period they have kept progressively increasing: during the year 1818, there were permitted in addition 300 hackney-chariots. Coaches and chariots now amount to 1200.

There has been of late an excellent regulation introduced, we understand, that of compelling the proprietors of hackney-coaches and chariots to affix the number up in the inside, as well as on its exterior, which enables the passengers to notice it better.

We read that in Russia there are employed clumsy, but very convenient sort of carriages, so constructed as to be either closed or open, and to hold a bed or couch, called *kibitka* and *brichka*, with which persons can travel even for 2 or 3000 miles without much inconvenience, except it be over the rough stones through their towns, owing to the superior accommodations of either lying down or sitting; this change of position renders a long journey less irksome, without which it would prove intolerable. In Russia, from *Riga* to the Crimea, at least, post-horses are furnished by the government, and intrusted to subalterns in the Russian armies to provide them.

Coaches for hire were established by public authority in France, as early as 1671; then called *brouettes*, invented by one Dupin. There are employed in the streets of the French capital, we understand, no less a number than 1800 hackney-coaches.

As early as the year 1650, Charles Villerme paid into the royal treasury 15,000 livres, for the exclusive privilege of keeping and using *fiacres* in that capital.

Post-chaises are said to have been introduced in the year 1664.

Hackney-coaches were established in Edinburgh in 1673, the number was then twenty. Public *fiacres* were introduced at Warsaw in 1778. In Copenhagen there are 100 hackney-coaches; in Vienna 200. In Amsterdam the coaches have no wheels; nor have they any at Petersburg in the winter.

The state coach of the city of London is a species of *heir-loom*, or the hereditary property of the city; it is a very large and apparently extremely heavy machine, but superbly decorated with large pannels of crystal glass, richly gilt, and elegantly painted with several appropriate designs. In one of the centre pannels, among a group of figures, is one supporting a shield bearing the inscription **Henry Fitzalwin, 1189**, in the old English, or rather a species of church-text character; therefore, we presume, the coach was constructed at a period coeval with the above date.

COCK-FIGHTING.

The reason alleged for the continuance of this barbarous custom by politicians, like numerous other of their axioms and conceits, is far remote from the wholesome doctrine of mere morality. Leaving civilized and rational christianity out of the question,—can any thing be regarded as more semi-barbarous, nay, more diabolical, than to incite innocent animals to those bloody contests which disgrace beings who ought to be rational.

But then the politician says it is expedient, in order to incite the courage of men, that they should have cock-fighting, bull-baiting, and other robust pugilistic exercises, in order, we suppose, to supply the place of the *gymnasticæ* of ancient Greece, (which, by-the-bye, were instituted for the purpose of promoting the health, and giving to the frame that activity so essential to its preservation;) as though those passions inherent in the nature of man did not receive a sufficient stimulus by the injuries to which he is every day, every hour exposed: but the sage Machiavelian steps in, and says, frequent contests will either incite men to more aggravation, or the exercise these afford will enable them to meet their adversary with better temper; and finally, the more they are exposed to domestic broils, the better able will they be to fight the battles of their country.—O shame upon such reasoning!—unworthy, because below the name of *sophism*. Taking the question

upon the most liberal principles,—we ask him, what is the end of good government in a Christian society? He should answer, to promote peace and observe such conduct as will tend to increase the general good of the commonweal; alleging, as his authority for the assertion, that such is the object of the laws and the religion we profess, which he thinks it *his duty* to support.

In allusion to the previous question, how can he reconcile this manifest difference?—whilst with one hand he holds the reward of peace, and in the other the incentive to war! But, by way of *salvo*, he thinks to reconcile this contradiction, by observing, that he does not encourage brutality for the purpose of embroiling his *countrymen* to fight among themselves, but that he wishes them to be hardy and able to fight the common enemy. This too, is but a very weak subterfuge. Does not he remember that courage does not inhabit the heart of the bravado, the loud, the quarrelsome?—also, that the quarrels and the pacification of nations is not given to those who are to decide the contest by blows, but that these are fixed upon even without asking their opinion? As they are not consulted, it really is of no importance; so that the soldier gets paid,—he never inquires with whom he is to fight; nor does he ever inquire into the equity of the thing,—knowing it does not depend upon his judgment: since his country commands and furnishes rewards, that is all he is ever anxious about; and there are always ready behind the scenes of the imperial *phantasmagoria*, a number of devices to magnify slight offences of our neighbours into monstrous and gigantic crimes,—so heinous and diabolical as to be placed beyond the pale of mediation, or any other expiatory retribution—but blood! This he, the minister, knows it is in the power of one of his chief engines to supply. With gold, the nerve of war, he can command myriads of venal pens to traduce and vilify any country; which the people must believe, because, forsooth, it appears on authority in public prints! We have seen too much of the infamous venality,—the lying falsehoods of the press, to countenance such errors, and have long laboured under privations in health and fortune in consequence of wars; but, notwithstanding the errors of governors, the crimes of rulers, their mistakes, wilful or accidental,—no power on earth shall ever shake the broad basis of our love of our country, which will exist to the last pulsation of life, and will only cease with consciousness.

But the question;—our subject beckons us to attend,

We now proceed to observe, that, at present, the *English* are almost the only people stigmatized by contemporary foreigners, and particularly by a celebrated German writer,¹ as being those, “Among whom cock-fighting is a favourite amusement; and on that account it is considered as peculiar to them, though it was esteemed among various nations many *centuries ago*.” Afterwards adding, “That it should have been retained there, though the practice of inciting animals to fight has been long scouted by moral and enlightened nations, is as singular an anomaly, as that the Spaniards should still continue their bull-fights, and that princes, who wish to avoid the appearance of cruelty, should nevertheless pursue, with immoderate passion, the detestable and so often condemned practice of hunting with dogs.”

The pastime, if pastime it can be called, appears very ancient, and suited to that detestable cruelty which characterise a savage nature.

The Réverend and learned Mr. *Pegge*, in the *Archæologia* of the Society of Antiquaries, vol. iii. p. 132, has essayed to prove the original of cock-fighting,—deducing it from the time of *Midas*, King of *Phrygia*, a contemporary with *Cræsus*, the sovereign of *Lydia*, 550 years before Christ, on the following occasion. *Adrastus*, one of the sons of the former prince, killed his brother in consequence of a dispute between them, which occurred at a quail-fight; on which *Adrastus* fled to *Cræsus*. Hence, he infers, quail-fighting must have been common at that period, according to the opinion of *Palmerius*;² and knowing that he had endeavoured to make it much older than he found any records to sanction his desire. He, however, supposes that *Adrastus*, the son of the Phrygian monarch, on account of this murder, fled to *Cræsus*, that prince living, as has been said, about 550 years before the Christian era. Quail-fighting, in the opinion of *Palmerius*, must have been customary at that time: in which case, he thinks we may admit *cock-fighting* to be of equal origin; and even between domestic fowls, because with them the contest is said to be more violent, which would afford more amusement. *Herodotus*,³ who relates the story of *Adrastus*, does not mention the cause of the quarrel; which omission is supplied by the historian *Ptolemy*, son of *Hephestion*, also called *Alexandrinus*, who lived contemporary with the

¹ Beckmann, vol. iv. p. 498.

² Jac. Palmerii Exercitationes in auctores Græcos. Ultraj. 1694, 4to. p. 3.

³ Lib. i. cap. 35 et 45. p. 21.

Emperors Trajan and Adrian.⁴ However, he only says, that the brothers quarrelled about a quail. Did any other corroborative relations exist to prove that cock or quail fighting was common about that time, it would not then be indeed deviating from historical probability to imagine that the quarrel took place during the pastime of quail-fighting.

Quails, as well as domestic cocks, are extremely irritable and quarrelsome birds; like cocks, they can be employed in fighting: but quail-fighting appears to have been first employed by the Romans, in whose writings it is often mentioned; whereas, among the Greeks, it seldom or never occurs,—whilst cock-fighting is repeatedly mentioned. Although the latter sported with quails, they did not do so by way of quarrelsome incitement.

The Romans appear to have bred and employed partridges for fighting. Lampridius relates, that the Emperor Alexander Severus was fond of seeing battles of this kind; and Ælian, who lived in Italy under Heliogabalus, in the second century, says, that those who kept partridges for fighting, when they pitted them, placed the females near to the males, to render them more courageous.

It is probable that Palmerius, who lived many centuries after the event, and took it up, most likely, upon traditional report only, judging that as quail-fighting was common among the Romans, he conceived it was likely to have been equally familiar to the Greeks and in Phrygia. But we submit the best opinions which can be offered upon this subject are merely conjectural; and, although the learned, as we have seen, have not been sparing of their trouble to endeavour to arrive at some certainty with respect to the antiquity of cock-fighting, as it relates to time; they might really have saved themselves much trouble had they for a moment reflected that it is in the nature of this bird to fight; and that, with it, fighting appears to be as natural as does any other of its propensities or habitual inclinations.

However, to leave the region of conjecture, we now advance upon firm historical ground, where we find it recorded, that upon one of the invasions of Greece by the

⁴ See Vossius de Historicis Græcis. Ludg. Bat. 1651. 4to. lib. ii. cap. 10. p. 213. Extracts from this book of Ptolemy, *περι παραδοξων ιστοριας*, may be found in *Photii Bibliotheca*, 1612. fol. p. 472. The words relating to this subject are: *και αναρρεθηναι αυτον (fratrem) περι ορτυγος φιλονικουντα*, et de coturnice contendente occubuisse.

the Persians, Themistocles commanding the Grecian forces, as the army was advancing to meet the enemy, they saw two cocks fighting; he made his army halt to behold them, at the same time observing, "They do not fight for their household gods, for the monuments of their ancestors, nor for glory, nor for liberty, nor safety of children; but only because one will not give way to the other." This is recorded by *Ælian* who adds, "Those observations so encouraged the army, that they fought like Greeks,—like men who had every thing dear and valuable dependent upon the issue of that day's exertions." They conquered an army, their superior in point of number, of ten to one. In consequence of this victory, the victory of *Marathon*, cock-fighting was enjoined as a public and sacred solemnity by the laws of Athens. But because it was common at Athens,—although with much pleasure we confess, we believe the Grecian people to have been among the first, the wisest, the bravest, the best, the most civilized, and polite of ancient nations: yet, considering the moral customs of society to have improved in the period of upwards of 2000 years, we cannot, in the present advanced state of our own times, see any possible reason why one of the most barbarous traits in the manners of the Athenians should be continued among us. They were a people supremely blessed by nature, assisted by art, and improved by a virtuous and wise legislation; but they had the great misfortune to have the chief source of their moral actions poisoned by false religious impressions,—the slaves of abject superstition; among them augury and divination by the flight, noise, and actions of birds and other animals, was suffered to direct them in their most important concerns. But shall it be said in our days, when we are supremely blessed by the infallible light of a purer creed; upon comparison, we may say, by the *purest* emanation of the Almighty will, respecting all that is proper for man to know. Then let us conjure our countrymen by that faith they profess—by that consciousness of it they experience—and by the gentle effulgence of unsullied humanity, which we know they are proud to acknowledge,—not to suffer the fame of their country to be any longer held up by surrounding nations as a *foil* to exhibit the superior brilliancy of European virtue. Let Britain be as superiorly eminent for every virtue as her bravery and wisdom remain unrivalled.

It has been remarked, that in the time of Julius Cæsar, cocks were kept in England, by the natives, for pleasure; but that fowls were not bred there for food. Pegge

says, the oldest information which he has found on this subject, occurs in the description of London by William Fitz-Stephens, a writer who lived in the reign of Henry II. and died A. D. 1191. This writer relates that on Shrove-Tuesday it was customary for school-boys to bring their game cocks to their master, when the whole forenoon was devoted to *cock-fighting*, for the amusement of the pupils. The theatre or cock-pit was consequently in the school-house; of the contest the pupils had the direction. In France, as early as 1260, cock-fighting was forbidden, by an order in council,⁵ from some mischief which it had occasioned.

This pastime met with the same fate in the reign of Edward III. even in England.⁶ Likewise in the reign of Henry VIII.;⁷ also later. But it is reported that the last-named monarch at another time encouraged it, and himself instituted cock-fighting.⁸ Moreover, a later writer has shown that James I. took great delight in that practice. Hence, it is presumed, the origin of the ancient building known as the Royal Cockpit, by Bird-cage-walk; but this is now a ruin, and we congratulate ourselves and country that the practice has of late years fell into much disuse, being now followed by the dregs of the people only, who have no knowledge of the superior delight arising from the soft claims of human feeling, and the eminent gratification of mental and intellectual pleasures.

In an *hieroglyphical* sense, a cock signifies a noble disposition of mind, there being no bird of a more generous nature, and undaunted courage at the sight of the most imminent danger.

We are told the ancients dedicated this noble bird to Apollo; it is said, because he is considered the harbinger of day. It was also sacred, we know, to Mercury, as the emblem of watchfulness; in this sense, we have occasion to believe it was viewed by the Egyptians in their hieroglyphical writings. The cock is said to have been sacred to *Thot* or *Taäut*, the Egyptian Mercury; on account of its watchfulness,—summoning men to their business by its crowing. The cock is also said to be generally placed at the top of church steeples, silently to remind prelates of their duty to bear a watchful eye over their flocks.

The cock, as the herald of day and centinel of the night,

⁵ Du Cange, *Glossarium*.

⁷ Maitland, p. 933. 1343.

⁶ Maitland's History of London, p. 101.

⁸ Ibid. p. 1343.

is borne in heraldry by many noble families. The ancient Gauls took this bird for their first standard, and wore its figure on their helmets for a crest.

An old English heraldic writer says, this bird is the type of a perfect soldier, being considered the king among domestic birds; being noble of courage, and always prepared for *battaile*; he has a comb for a helmet, a sharp crooked bill for a falchion, to scalp or wound his enemy; like a complete soldier, he is armed *cap-à-pie* with spurs,⁹ giving an example to the valiant to expel danger by fight, not by flight.—*Gwillim*.

This bird is said to be indigenous in China,¹⁰ Persia,¹¹ Hindostan, the Malacca Islands,¹² Pulo Condor, and many of the South Sea Islands, and several parts of India,¹³ where it is found in a wild state. The true game fowls came originally from Persia; as we are informed by Hyde, *de Religione Persarum*.

EAU DE LUCE.

Eau de Luce is a compound of as late invention as 1742; yet, although so very recent, we have not been able to ascertain the name of the inventor with satisfactory certainty. Among so many claimants for this honour, it is difficult, with a consciousness of rectitude, to confer it upon any one individual. However, the best information in our power, we will submit to the more penetrating judgment of our readers.

Those eminent chymists, Neumann, Hoffmann, Boerhaave, and their contemporaries, appear to have published recipes: the latter named author in *Elementa Chemicæ*, 1732. 4to. ii. p. 370. and *Fr. Hoffmanni Observat. Physico-Chymie*. lib. ii. obs. 11. Those writers at the period above stated, in their works, speak of similar compounds; and so do many contemporary chymical authors.

Various surmises have been suggested, to discover the name of the inventor; some have endeavoured to trace it by the name of the composition, to that of the manufacturer. But the most prevailing opinion appears to be, that,

⁹ The English, like the Greeks, frequently arm the cock with steel spurs; it is thought to render the conflict more sanguinary.

¹⁰ Bell's Travels, p. 303.

¹¹ Tavernier.

¹² Cook's Voyages.—Dampier, *Suite du Voyage de la Nouvelle Hollande*, v. p. 61.

¹³ Sonnerat, *Reise nach Ostindien*. Zürich, 1783. 4to. ii. p. 117. where there is also a figure of the wild fowls.

by the name of the composition, that of the local situation where it was first discovered is given.

However, it should be noticed, that the name *de Luce*, will admit of so many interpretations that nothing conclusive can be adjusted or deduced from it; some say it should be *Aqua Luccana*,¹ some *Aqua St. Lucie*,² others say, *Aqua Lucii*;³ whilst there are not wanting those who write it *Eau de Lusse*. A respectable opinion, however, appears in favour of an apothecary of Lisle in Flanders, or at Amsterdam, who they say was named *Luce*; they allege that he was the inventor, on the authority of *Malouin*, the editor of *Lemery's* chymistry; that of *Lier* and others.

Numbers of the French writers will have it, that it was first invented in Paris, by an apothecary, whose name was *Dubalen*, who, they say, with his successor, *Juliot*, long kept the preparation a secret.

It has been since discovered to consist of a caustic volatile alkali, and highly purified oil of amber. When these materials are pure, it retains a milky appearance. It is generally sold by perfumers. It is employed as a soap, to remove spots from cloth which cannot be affected by common soap; mixed with water, it is also administered as a medicine for various accidents and diseases; it is considered as an antidote against those dreadful effects which would accrue from the bite of certain snakes: by reason of its strong and very pleasant smell, it operates as a powerful stimulant in fainting. *But this essential caution should be always remembered, that if a particle of it comes in contact with the eye, it will produce blindness.* Some instances of this, have, we understand, been recorded in the *Gazette Sautaire*.

It is remarked, that one of our countrymen, of the name of *Dossie*, was among the first who gave an account of the proper way of preparing it, with its constituent parts, in his publication intituled *The Elaboratory laid open*, published in 1758.

It ought not to be omitted, that the observation has been made that Parisian *Eau de Luce*, is conceived to be the most properly prepared: it usually retains its milky appearance, its fine smell, and other virtues; whereas, there was a spurious sort manufactured in Flanders and Holland,

¹ Wallerius Physische Chemic, ii. p. 348.

² Gmelin Apparatus Medicaminum. Regnum miner. i. p. 101.

³ Stockar de Neuforn Diss. de Succino. Ludg. Bat. 1760. p. 65.

said to be of a blue green colour. From the novelty of this colour, it nearly superseded, for some length of time, the use of the original and most proper species. That of a blue colour was certainly made by an apothecary of the name of *Luce*, at Lisle; the blue colour he gave it is conjectured to have come from using spirit of sal ammoniac with the oil of amber instead of a purer alkali.

ETCHING ON GLASS AND GLASS-CUTTING.

Without entering into the history of the lapidary's art, we only propose to speak of those things which ancient and modern authors have said upon the art of engraving on glass, observing, that it was an art evidently known to both the Greeks and Romans. Although it appears extremely probable, that, from their confessed ignorance of many of those properties which modern chymistry has discovered to belong to matter; they were ignorant of the art of etching on glass.

From antique specimens still preserved, a doubt cannot for a moment be suffered to exist on our mind but that the art of engraving upon glass was familiar to the Greek artists, who formed upon glass both linear figures, and also in relievo, by the same means as are now employed for nearly similar purposes, if we can place any credit in an able and learned lapidary, *Natter*,¹ who has established that the ancients employed the same kind of instruments for this purpose, or nearly such as are now in use; abating, perhaps, the use of diamonds, and the dust of that precious material: for which it is conceived they employed emery powder, and the dust of glass.

From what is related by Pliny, it certainly appears that they used the lapidary's wheel, an instrument moving in an horizontal direction over the work table. *Natter's* assertion renders what Pliny asserts intelligible: *Aliud flatu figuratur, aliud tarno teritur, aliud argenti modo cælatur*.²

However, in the latter part of this sentence, we must believe the mode employed by silversmiths in the operation of certain engravings, is only alluded unto, for their tools, of necessity, must be essentially different, with the excep-

¹ *Traité de la Méthode antique de graver en Pierres fines, comparé avec le methode moderne*; par Laur. Natter. Londres, 1754, fol.

² Lib. xxxvi. 26. p. 758.

tion of the wheel; the silversmith using hard and well tempered steel, whilst there is room to believe the lapidary, perhaps, and glass-cutter, employed soft iron, with its pores well filled with diamond powder.

Some have thought that drinking cups and vessels may have been formed from the glass metal whilst in a state of fusion, by means of this wheel; to this they think those words of *Martial* refer, for in his 14th ep. 94, he says, *calices audaces*, having reference to the boldness of the artisan's touch; those vessels he was constructing often broke under the last touch he bestowed upon his transparent labours, although perhaps of the most costly value; these accidents must of necessity have rendered those articles extremely expensive.

There are not wanting many who affirm the art of glass-cutting, with the instruments necessary for that operation, to be of modern invention. Those assign it to the ingenuity of *Caspar Lehmann*, originally an engraver on iron and steel, and who, as *Beckmann* informs us, made an attempt, which succeeded, of cutting crystal, and afterwards glass, in the same manner. This artist, we are told, was in the service of *Rodolphus*, the second Emperor of that name, who, in the year 1609, besides giving him valuable presents, conferred on him the title of lapidary and glass-cutter to his court, and gave him a patent, allowing him the exclusive privilege of exercising this new art. He worked at *Prague*, where he had an assistant named *Zacharias Belzer*; but *George Schwanhard*, the elder, one of his pupils carried on the same business to a much larger extent. The last named was a son of *Hans Schwanhard*, a joiner at *Rothenburg*, and was born in 1601; at the age of seventeen he went *Prague*, to learn the art of cutting glass from *Lehmann*. His good behaviour won so much upon the affections of his master, that on his death, in the year 1622, being a bachelor, he left him his heir; he also obtained from the Emperor *Rodolphus* a continuation of *Lehmann's* patent. *Schwanhard* removed to *Nuremberg*, where he wrought for many of the chief nobility and potentates of that district. This was, we understand, the occasion of that city claiming the honour of being the birth-place of this new art. In the year 1652, he worked at *Prague*, and also at *Ratisbon*, by command of the Emperor *Ferdinand III.* and he died in 1676. He left two sons, who both followed the lucrative occupation of their father; the elder, of the same name with his father, died as early as 1676, but his brother, *Henry*, survived him several years. Afterwards,

Nuremberg produced many expert masters in the art, who, from the improvement in the tools of it, and also from discovering more economical modes of employing them, were enabled to execute the orders of the public at a much cheaper rate than had been heretofore charged for some articles. Those latter masters likewise brought this art to a much greater degree of perfection.³ Notwithstanding Zahn was of the same country, and must have been, it is probable, apprised of the facts previously stated; yet he, in his *Oculus Artificial*. iii. p. 79, apparently speaks of it as a very recent invention at Nuremberg, at the time he wrote. He also furnishes a plate, giving at the same time a description of the various instruments employed. However, that this invention is not purely *novel*, may be seen from those facts already submitted.

It should be stated, that before this latter re-introduction, artists used, with a diamond, to cut figures upon glass in almost every form, as far as the representation by lines went. The history of diamonds has been written by Mr. Mawe, in his observations on the diamond districts of Brazil; It appears to be yet undetermined whether the ancients used that stone for the purpose of cutting others; upon this point Pliny,⁴ according to our reading of this passage, appears to say it would be desirable; his words are, “*Expetuntur a scalptoribus, ferroque includuntur, nullam non duritiam ex facili cavantes.*”

Solinus and Isidore, both express themselves in a manner nearly as undecided. But, although this may leave us in some doubt, it appears pretty clear that they did not attempt to cut that valuable production with its own dust, or to give it different faces, or render it more brilliant by the same means. If this point was settled, there could be no great difficulty in affirming or negating the fact of their engraving upon that stone. Thus doubts appear to increase on this head, for Mariette denies that they did; Natter appears uncertain; and Klotz asserts with confidence it was certain. His authority, to be sure, has been considered not to be of much weight.

The proper question, however, appears to be, whether the Greeks and Romans used diamonds for cutting and engraving other stones or glass. Natter, in his work before cited, thinks they were employed on some antique en-

³ Sandrart's *Teutsche Akademie*, apud Beckmann.

⁴ Lib. xxxvii. 4. p. 773.

gravings. His authority carries respect. But if they were employed on other stones, the authority which at present directs us, confidently alleges they did not employ them in cutting glass; but he points out the mode in which that article was wont to be divided, in the following terms: “They used, for that purpose, emery, sharp-pointed instruments of the hardest steel, and a red hot iron, by which they directed the rents at their pleasure.”⁵

The first mention which appears to occur of the use of the diamond, for this purpose, is recorded of Francis I. of France, who, fond of the arts, sciences, and new inventions,⁶ wrote the following lines with a diamond, on a pane of glass in the castle of Chambord, to let Anne de Pisseleu, Duchess of Estampes, know that he was jealous:

*Souvent femme varie,
Mal habil qui s'y fie.*

It is the occasion alone that records these lines. About 1652, festoons and other ornaments cut with a diamond, were made on Venetian glasses; then considered the best. George Schwanhard, the elder, was a professed adept in that art. And since his time an artist of the name of John Rost, of Augsburg, cut some drinking glasses, which were purchased by the Emperor Charles VI.

ETCHING ON GLASS.—An acid to dissolve siliceous earth was discovered as late as 1771, by the famous chymist Scheele, in *sparry fluor*. It is conceived that this art cannot be of an older date than that period; but it is alleged that an acid was discovered as early as the year 1670, by the previously named Henry Schwanhard. It being said that some aquafortis had dropped, by accident, upon his spectacles, the glass being corroded by it, he thence learnt so to improve the liquid that he could etch figures and writing upon glass. How he prepared this liquid is a secret which has not been revealed. The *Teutsche Akademie*, before quoted, says on this subject, that he, by the acuteness of his genius, proved that which had been considered impossible could be accomplished; and found out a corrosive so powerful that the hardest crystal glass, which had hitherto withstood the force of the strongest spirits, was obliged to yield to it, as well as metals and stones. By these means he delineated and etched on glass figures of men, in various situations,

⁵ Le Veil, Die Kunst auf glas zu malen. Nurnb. 1780, 4to. iii. p. 19.

⁶ Daniel Geschichte von Frankr. viii. p. 570.

animals and plants, in a manner perfectly natural, and brought them to the highest perfection.

The glass proposed to be etched is made perfectly free from grease and clean, then the figure is covered with a varnish, then an edge of wax being raised round the glass, the acid is poured in, and the whole ground on the exterior of the figure appears rough, whilst the figure is preserved in its original beauty of outline, bright and smooth. This is the mode the inventor adopted.

Professor Beckmann says, he mentioned this ancient method of etching upon glass to an artist of the name of Klindworth, who possessed great dexterity in such arts, and requested him to try it; he drew a tree with oil varnish and colours, on a plate of glass, applied the acid on the plate in the usual manner; after it had been upon the plate for a sufficient time, poured off, and the plate afterwards cleaned of the varnish; a beautiful tree was left bright and smooth, with a rough back ground. It is conceived that many great improvements may be yet made in this process.

It appears that no other kind of acid than that produced by the sparry fluor is capable of corroding every kind of glass, though Baume, in his *Experimental Chemie*, iii. p. 302, says that many kinds of glass may be corroded by the marine and vitriolic acids.

In this state of uncertainty was the public mind till the year 1725, when it was thought that a recipe older than that previously mentioned might possibly be discovered. Accordingly, in that year, in the month of January, in the *Œkonomische Encyclopedie*, xi. p. 678; the following is said to be transmitted to the publisher by Dr. John George Weygand, of Goldingen, which is reported to have belonged to Dr. Matth. Pauli, of Dresden, then deceased, with which the last named gentleman had etched on glass, arms, landscapes, and figures of various kinds. We find that in it strong acid of nitre was used, which entirely disengages the acid of sparry fluor, though the vitriolic acid has been commonly employed, and figures thus produced will appear as if raised above the plane of the glass.

This sparry fluor is found among Derbyshire productions as well as in the mines of Germany. Theophrastus is the first who notices the effect of sparry fluor, by observing, that there are certain stones which, when added to silver, copper, and iron ores, become fluid. It appears that Cronstedt was the first systematic writer who gave it a name.

When *spiritus nitri per distillationem* has passed into the

recipient, ply it with a strong fire, and when well dephlegmated, pour it, as it corrodes ordinary glass, into a Waldenburg flask; then throw into it a pulverised green Bohemian emerald, otherwise called *hesphorus* (which, when reduced to powder and heated, emits in the dark a green light,) and place it in warm sand for twenty-four hours. Take a piece of glass, well cleaned and freed from all grease by means of a ley, put a border of wax round it, about an inch in height, and cover it equally all over with the above acid. The longer you let it stand so much the better, and at the end of some time the glass will be corroded, and the figures, which have been traced out with sulphur and varnish, will appear as if raised above the plane of the glass.

FALCONRY.

The researches of *Flavius Blondus*¹ and *Laurentius Valla*,² both of them writers as early as the fifteenth century, have negatived the question, which, we understand, had subsisted before their time, as to the knowledge, or, at least, the use of falconry among the ancient Greeks. *Rigault*,³ *Pancirollus*, *Salmuth*, and others, have concurred

¹ Blondus, or Biondo, in describing an Italian village, says, "I shall embrace this opportunity of mentioning a new circumstance, which is, that fowling with that rapacious bird the falcon, a diversion much followed at Arno, by the celebrated Alphonsus, King of Arragon, was entirely unknown about two hundred years ago; for though Servius, the grammarian, says that Capua received that name from the augury of a falcon, because the Hetruscans, when founding it, saw one of these birds, which in their language was called *capis*; yet he does not tell us of what use they were to mankind. Besides, Pliny, who gives the names of many rapacious birds of the hawk kind, (*accipitres scilicet majores et minores achilvones, quos aliqui falcones fuisse volunt*,) says nothing of their being employed to catch game; and, without doubt, had fowling in this manner been practised in the time of Virgil, he would have made Æneas and Dido carry such birds along with them when they went out a hunting, whereas he says only:

"Massyllique ruunt equites et odora canum vis.

"I will venture, therefore, to affirm, that two hundred years ago, as I have already said, no nation or people were accustomed to catch either land or water-fowls with any rapacious bird tamed for that purpose."

² Valla, the most learned man of the century in which he lived, contradicts Antonius Renaudensis, who says, *Nola* is a hawk's bell. "If *Nola*," says Valla, "be an old word, it cannot signify that bell now worn by hawks, because the ancients never tamed these birds for catching game, as we do, nor ornamented them with bells. If it be a new word, let him produce the author from whom it is taken." *Laurentii Vallæ Opera*. Basilæ, 1543, fol. p. 433.

³ In the preface to *Scriptores rei accipitrariæ*.

in their opinion. It appears, that *Giraldus* admitted they knew something of falconry;⁴ although a modern writer⁵ says, he believes they knew nothing of hawking, which he defines to be chasing game with birds of prey, as practised in modern times; which, he remarks, serves more for the amusement of trifling princes than for any useful purpose. He also adds, "That they had *begun* to employ the rapacity of some of the winged tribe in hunting and fowling, in his opinion, cannot be denied." We shall see by an annexed note, that falconry has been practised from the earliest times in *Siberian Tartary*, and *India*.

So early as the time of Ctesias, (contemporary with Alexander the Great,) we understand, hares and foxes were hunted in India, by means of rapacious birds.⁶ The account given by Aristotle, appears to confirm the practice of falconry or hawking among the Thracians, where, he says, "In Thrace the men go out to catch birds with hawks. The men beat the reeds and bushes which grow in marshy places, in order to raise the small birds, which the hawks pursue and drive to the ground, where the fowler kills them with poles."⁷

It has been well remarked, that one part of history assists in clearing up the doubts on other parts. Surely never was this observation better verified than it appears in the present instance: for from the previous notes, it seems, the learned Europeans, only familiar with Grecian and Latin histories, knew nothing of what had been transacted in the north of Asia; and we observe in *Von Strahlenberg*, that falconry has been an ancient custom in Tartary; which also assists in confirming *M. Bailly's* conception; see his *Histoire d'Astron.* that the origin of most arts, sciences, customs, &c. originated in the north of Asia; which conception is also confirmed in an expression of a reverend English historian of the stellary science, Mr. Costard, who says it was reported by the Jesuits that the Grand Lama possessed some most ancient

⁴ Lillii Greg. Gyraldi Dialogismus vi. in his works printed at Leyden, 1696, fol. tom. ii. p. 870. These *dialogismi* may be also found in Gruter's *Thesaurus criticus*, vol. ii. p. 397.

⁵ Professor Beckmann, vol. i. p. 320.

⁶ Λαγωὺς δὲ καὶ ἀλώπεκας θηρεύουσιν, οὐ τοῖς κυσίν, ἀλλὰ κοραξὶ καὶ ἰκτίσι καὶ κορώναις καὶ αἰτοῖς. Ctesiae Indica; Herodot. Histor. Francof. 1608, fol. p. 660. In India also the antelope, which is too swift for the fleetest dogs, is usually stopped in its course by a falcon.—*Nicholson's Encyclop.*

⁷ In that part of Thrace, called formerly Cedropolis, the men go out into the marshes in quest of birds, accompanied by falcons. The men beat the trees and bushes with poles, and put the birds to flight; the hawks fly after them, by which means they are so frightened that they fall to the ground, where the men strike them with their poles, and kill them. *Histor. Animal.* lib. ix. c. 6, edit. Scaligeri.

books, which reported the building of Babel, &c. Here we see the application of these several memoirs, and observe they all tend to clear up a most desirable piece of ancient historical information; and that here the conception of the great *Leibnitz* appears to be well founded, who recommends the study of the northern languages, with a view to assist in ascertaining the migration of human society; and its accomplishment is most desirable.

The Grecian authors previously quoted call the rapacious birds above alluded unto, *ἱερανεσ;* Pliny names them *accipitres*. From the want of correct classification, it becomes difficult to distinguish the genus of the species so named; or even to understand which kind of birds they specifically meant, where they have attempted to define individuals of the class. Besides, such birds are known to be affected by the contingencies of age, and the seasons of the year, which, as far as colour goes, often produce a change; from hence, it might happen, that the ancients of one species formed two, and sometimes more. Another consideration will be found highly probable to have increased this confusion: which is their belief that new species of those birds were produced by promiscuous copulation. We believe it is now ascertained no such intercourse takes place. However, it appears pretty certain that the ancients divided those birds of prey, which appear by day, into three classes; *i. e.* *αετος*, *aquila*; *γυψ*, *vultur*; and *ἱεραξ*, *accipiter*. The first and last belong to that genus which LINNÆUS calls *falco*, and are the larger species. The vultures are the *geir-falcons*, distinguished by a bald head and neck.

An account nearly similar to the former appears in another book ascribed to Aristotle, but much more wonderful, from certain distinguishing traits; it, however, appears to be a production not much later than his day, but accompanied by additions which serve to increase our wonder. The first is, that in Thrace, the falcons appear when called by name; and the second, that they brought to the fowlers whatever they had caught, of their own accord.⁸ It has been observed, that no distinction exists between modern falconry and that of the ancients; but that the moderns have the aid of a spaniel to discover the game, a hood for the head of the hawk, whilst it is perched upon the hand or arm of the fowler, with the string tied to its foot to hold it by. Our modern falconers so nearly resemble in their practice the ancient Thracians, that they generally make their carnivorous feathered partners, participators in the prey they

⁸ De Mirabilibus Auscultat, cap. 128.

bring them, by giving them some small portion of it for their share.

Writers subsequent to Aristotle, as *Antigonus*,⁹ *Ælian*,¹⁰ *Pliny*,¹¹ and *Phile*,¹² have also contributed an account of this method of fowling. *Ælian*, who has been observed not to render correct verbal transcripts, says to the preceding effect, with this distinction, that in Thrace nets were used. In this *Phile* has imitated him in his stanzas. *Ælian*, also has in another place described the manner of hawking in India: travellers since his time say it is still practised in Persia, being there well understood, as well as among other oriental nations.

From these sources we collect that the Indians hunt hares and foxes in the following manner: having previously trained up their birds as follows, they use for this employ, eagles,¹³ kites, and crows; but the kite, it seems, is a favourite bird; they catch them whilst young, and thus domesticate them. They let a hare or fox loose, with a piece of flesh fastened on its back, which those birds pursue for the sake of the flesh; on their return, they receive it as the reward of their

⁹ Antigoni Carystii Historiæ mirabiles, cap. 34.

¹⁰ Hawks, which are no less fit for fowling than eagles, are not inferior to them in size, are of all birds reckoned to be the most docile and fondest of man. I have heard, that in *Thrace*, they accompany people when they go in quest of birds in the fens. The fowlers, having spread their nets, remain quiet, while the hawks flying about terrify the birds, and drive them into them. When the Thracians catch any birds, they divide them with the hawks, by which means they render them faithful partners in fowling: if they did not give them a share of the booty, they would be deprived of their assistance. *Histor. Anim.* lib. ii. cap. 42.

¹¹ In a part of Thrace above Amphipolis, men and hawks go out a fowling, as it were, in company. The former drive the birds from the bushes and reeds, whilst the latter fly after them and strike them down. The fowlers divide with them their prey, &c. Lib. x. cap. 8.

¹² *Phile de Animal. Proprietate*, according to Bersmann's translation, p. 36.

Post multinodas quam plagas venatibus
Thraces tetenderunt, latent absconditi;
Quos advolantes cominus circi juvant,
Metuque territant volucres belluas,
Laxata condant subter ut se retia.
Quas Thraces arctis implicatas cassibus
Cohorte densa, comprehendunt acriter,
Circisque mercedem rependunt debitam,
His portionem largientes alitum.
Quod ni fit, ope post destitutos videris
Ponunt volantum cum laqueos rursus gregi.

¹³ "There are three sorts of eagles in Siberia; the first and largest sort exceeds a turkey-cock in size, this the Tartars call *burskut*; they are coal black, and so is their very beak: the skin about the nostrils and legs is of a lemon colour. They live chiefly on high mountains and in thick woods. The second, is called in the Tartarian tongue *kutscugan*; and the third and least sort *karakusch*, in Latin *aquila mævia*. The Tartars make use of this sort of eagles, as they do of falcons for hunting." *Von Strahlenberg's Historio-Geog. Description of the North and North-East of Europe*, &c.

labour. When thus instructed to pursue their prey, they are sent after wild foxes and hares in the mountains, they follow them in hope of obtaining their usual food, soon catch them, and bring them to their masters, as Ctesias informs us, who, instead of their usual flesh, give them the intestines of the wild ones they have caught. *Æliani Hist. Animal.* lib. iv. cap. 26; see also *Le Pluché*, in *Spectacle de la Nature*; see likewise Chardin's Travels in Persia, and also Gemelli Carreri.

It should seem, therefore, that the first information the Greeks received of these practices were all foreign to their own soil, coming from India and Thrace, and we may add Siberia.¹⁴ From what has transpired, it does not appear this practice was introduced very early into Greece.

In Italy, however, it must have been common, for both *Martial*¹⁵ and *Apuleius* speak of it as a thing generally known. The former calls a hawk a fowler's servant, and the latter puns upon the word *accipiter*, which also implies a rapacious kind of fish, in his *Apologia*, p. 296: "Me-

¹⁴ "In the province of *Dauria*, and near the river *Amour*, there are a great many milk-white *falcons*, which are sent in large numbers to *China*. The antiquity of this kind of sport among the Tartars, Kalmucs, and other people, inhabiting *Siberia*, appears partly in this, that they were used to have a representation of this sport painted or etched on the urns which they put into their graves." The author here refers to a graphic representation which he gives,—the original of which, he says, was dug out of a tomb, not far from the city of *Crasnoyahr*; "and partly by their sending a fine *falcon*, whenever they had a mind to make an extraordinary present to some great person. (See *L'Hist. des Tartars*, cap. viii. p. 205;) whence *Mezeray's* opinion in his *Hist.* part i. *additament*, Paris, 1685, seems not to be ill-grounded, when he supposes the ancient *Germans* had learned this sport of the *Scyths*. How common hawking is, even at this day, in *Mingrelia* and *Dagestan*, the above-cited writer of the latest account of *Casan* and *Astracan*, &c. (p. 178 and 315,) will satisfy the reader. The *Tartars* in *Siberia* make use of three sorts of *falcons*. The first is called in their tongue, *hkartschega aholphei*, or *tzungar*, which is the best and most beautiful sort; these *falcons* are ash-coloured, and some speckled white, and pretty large. The second sort they call *uguginala*. The third *toracktschin*. Whichever sort they be, it is necessary to make them fit for sport whilst they are young, which is done by these people in the following manner: after a *falcon* has been well fed, and is fat, they give them the bigness of a pepper-corn of a root they call *ack-chirgak*, put among some flesh, chopped small; this root is of an emetic quality, and has its effect upon the birds: in the next place, they take a piece of woollen felt, of the bigness of a nut, this they mince among some flesh, make a little ball of it, and make the bird eat it; this done, they cause him to be carried upon a man's hand from nine to twelve days, to prevent his sleeping: after which time, they mix some *calmus* among his meat, and by that time he is used to the falconer. However, before they venture him at large, they make him start and return within small compass. It is to be observed, that the *Tartars* never stroke their *falcons* over the head and back, which they believe makes them shy. They use the same method with *eagles*."—*Von Strahlenberg's Hist.-Geog. Description of the North and North-East of Europe*, &c. p. 362.

¹⁵ *Prædo fuit volucrum, famulus nunc aucupis; idem Decipit, et captas non sibi mœret aves.*

Martial, *Epigr.* lib. xiv. 216.

“ mento tamen tam ridiculum argumentum fore, desiderata
 “ ad res venereas marina obscoena, quam si dicas marinum
 “ pectinem comendo capillo quæsitum, vel aucupandis vo-
 “ lantibus piscem accipitrem, aut venandis apris piscem
 “ apriculum, aut eliciendis mortuis marina calvaria.” Which
 apology he made from his having been accused of collecting
 sea-animals with indecent names for obscene purposes.

It cannot be said this art was ever forgotten, although it
 has assuredly, since the invention of guns and gunpowder,
 fallen into disuse, at least in Europe. Like other inventions,
 though at first much admired, when once its novelty had
 ceased to attract, it is natural to presume it was somewhat neg-
 lected, especially among civilized nations, where were other
 resources to supply natural wants. Certain it is, that at one
 period it was perfected. The Romans laws¹⁶ of the latter
 period recognise it, as do many writers of the fourth and
 fifth centuries.

Julius Firmicus Maternus, who wrote in the time of Con-
 stantine the Great, anno 336, says, in his *Astronomicon*, in
 which he teaches the art of casting nativities, assures his
 readers that those born under the influence of certain signs,
 will become great sportsmen and keep hounds and *falcons*.
 Caius Sollius Apollinaris Sidonius, who was contemporary
 with the Emperor *Avitus*, celebrates his wife's brother, Her-
 dicius, because he first practised in his territories hunting
 and fowling with dogs and hawks. The same author, in
 other parts of his work, mentions hawking.

Hunting, and all its concomitant arts, at first were
 employed for purposes of utility: those arts, however, in
 subsequent ages, when the necessities of man were curtailed
 by the superior arts of civilization, became disused; what had
 at first been useful, now became an article of luxury: accord-
 ingly, we discover it was monopolized by the powerful and opu-
 lent, and princes and feudal lords claimed the chase as their
 exclusive prerogative; therefore, whilst it was so engrossed,
 it received every improvement that superior art could sug-
 gest. During the dark ages, and even in our own time,¹⁷

¹⁶ The words here alluded to are in Digest, lib. xliii. tit. 24, 22. “ Ne is, qui
 duntaxat iter per fundum meum fecerit, aut avem egerit, venatusve fuerit, sine
 ullo opere, hoc interdicto teneatur.”

¹⁷ The abbey church of Great Malvern, in the county of Worcester, which has
 been for ages eminent for the finest specimens of stained glass, in the quantity and
 quality of its workmanship, not to be surpassed by any known example in Eng-
 land, was, through the wilful negligence of a former incumbent, a *huntsman*,
 brought in *his time* into a state of ruin and decay.

A gentleman, who viewed this fabric in 1738, has left the following picture of its
 desolation. “ On the north side of the church was a play-ground for ‘ school’-

we recollect the idle portion of the clergy frequently indulged in those barbarous sports, being now privileged by laws which

boys, whose recreation consisted in throwing stones at the numerous windows full (as was previously noticed) of the most beautiful stained glass ; and adjoining this play-ground was a *dog-kennel*, from whence hideous yells filled at intervals (service time, or otherwise) the cry of the unrestrained juvenile assailants. In the interior of the church, on the eastern wall of Jesus' Chapel, was stuck up a large pigeon-house, belonging to the vicar, (*as did the school and dogs,*) then the Reverend Mr. Philips, who enjoyed the vicarage for near fifty years, and died May 1801."—*Antiquarian and Topographical Cabinet*, vol. i.

To the honour of the present vicar, the Reverend Mr. Graves, son of the venerable rector of Claverton, a subscription has been raised to endeavour to remedy the prostration and destruction which his unworthy predecessor had occasioned. But repairs of the nature of these are, we know, impossible even in architecture, at least, with such artisans as a village or country town can afford. It is physically impossible for those rude hands, whom parsimonious churchwardens will select, or rather choose without selection, because they come the cheapest, to imitate the laborious delicacy of the architects of ancient days. We have seen this fabric before it was repaired and since, and therefore are, perhaps, qualified to judge of the effect produced. To see the careless smears of vulgar whitening bedaubing all that was beautiful or tasteful in the Saxon tracing of the masonry, is to us horridly disgusting. To repair or reinstate any antique building, doubtless, must require the first professional skill of the most learned architects. What these, under such circumstances can produce, the recent repairs of Henry the Seventh's chapel, at Westminster, can testify ; (this church, by-the-bye, is presumed to have been built by the same architect who built that chapel, Sir Reginald Bray, as his picture, with that of Prince Arthur, was among the paintings on stained glass,) a work that does the greatest honour to whomsoever has the direction.

The very elegant pen of Dr. Brooker produced some charming lines upon this celebrated church ; as it, with its beautiful vicinity, cannot be too much admired, we shall be pardoned if we insert them.

“ What marvel, that a scene so rich, so grand,
Should admiration e'en in royal breasts
Awaken ?* Admiration, that inspir'd
Of old, for yonder venerable pile,
Devotion, and munificence, and zeal,
To rear those richly tinted windows ; now,
Alas ! with ivy, and with weedy moss
Obtrusive hung : some by the gusty wind,
Or striplings—thoughtless in their boyish sports—
Fractur'd ; and heedlessly by hand uncouth
With ill according workmanship repair'd,
Such once their grandeur—that, in sequence, told
Man's bliss primeval, and too speedy fall ;
His various fortunes in time's earliest age,
Recorded in Jehovah's sacred tome ;—
Nor less mysterious those, how God's own Son
In later time perform'd, depicted there :
His restoration of the sick and lame
To health and soundness,—of the deaf and blind
To hearing and to sight, the dead to life !
His conquest o'er grim death—
Soul damning sin !—Then, (with eventful truths
Countless, and of concernment great to man,
From time's beginning, to its last dread hour,)

* It appears to have been a favourite spot with Henry VII. who bestowed large donations.

cannot be regarded as wholesome. However, formerly they frequently have received the healthy admonitions and prohibitory mandates of their superiors in the church, from consistories and councils, as of *Agda*, anno 506; *Epaon*, in 517; and *Macon*, in 585; and probably oftener, but with little success. So incorrigible are their self-sufficient and upstart hearts. Here Christianity has failed of its effect.

It may be also observed, that Pietro Crescentio gives one *Daucus* as the inventor of the art of taming hawks, but without proof, as also void of probability. He likewise says, the ancients trained up to hunting and fishing some animals which are not now used for those purposes, such, for instance, as the seal and sea-wolf. *Astruc* has endeavoured to confute him. It also appears to have been an opinion, sanctioned by the judgment of *Rondelet*, *Isaac Vossius*, and Professor *Beckmann*, who says, he has himself seen a seal perform wonderful tricks when commanded by his master.

Falconry appears to have arisen to its greatest perfection, and to have been much in repute at the principal European courts about the twelfth century. On that account, as most of the useful arts are presumed to have had their origin from some illustrious person, like as in China, where all that is of utility is ascribed, according to *De Pauw*, to one or other of their Emperors;—so falconry has been in Germany given to Frederic I. and Frederic II. Frederic I. called *Barbarossa*, is admitted to have been the first who cultivated falconry in modern Italy, as Pandolfo Collenuccio alleges this was a common report, which Radevicius agrees to confirm; but his authority is, as appears, unknown. We are likewise in the dark respecting authority, when Pancirollus tells us that that Emperor *invented* falconry, whilst he was besieging Rome. It appears settled, that Rainaldo, Marquis

In order due, magnificently there
Were pictur'd,—once effulgent as the sun;
Now like the moon obscur'd, but dimly seen.

“ Restore, O piety of modern times!
Restore them to their pride: what ancient zeal,
The generous zeal of better days, bestow'd,
At least preserve, and let not ruin's tooth
Insatiate, prey on pearls. Away, away
With all that is unseemly from God's house:
Endure not there what would be nuisance deem'd
Within your own; nor let the observant muse,
Who so much all around sees fit to praise,
There only censure,—where not e'en the sound
Of censure's voice should pain the pious ear.”

* * * * *

of *Este*, was the first among the Italian princes who used this method of fowling;¹⁸ and that the Emperor Henry followed this example of his father's steps, is proved by the words of Collenuccio. "Fu (Enrico) dato estremamente all' essercitio della caccia, et dell' uccellare con falconi, et uccelli di rapina; il qual modo d'uccellare, è fama, che Federico suo padre fosse il primo autore, che lo portasse in Italia." *Compendio dell' Istoria del Regno di Napoli, di Pandolfo Collenuccio, di Mambrino Roseo e di Tom. Costo.* In Venetia, 1613, 4to. i. p. 88. The service which Frederic II. rendered to this art, is seen in a book he wrote in Latin upon it, intituled *De Arte Venandi cum Avibus*, which was printed for the first time at Augsburg, anno 1596, from a MS. belonging to Joachim Camerarius, a physician at Nuremberg.¹⁹ Deficiencies sometimes occur, from *lacunæ* in the manuscript, and there are some additions by the author's son Manfred, King of Sicily. The hood worn by the hawk, is said to have been an Arabian invention. The Emperor had received presents of falcons from some Arabian princes, and also procured skilful persons from that country who could manage those birds in a superior manner.²⁰ Albertus Magnus is presumed to have inserted much from this work into his book, which treats of animals.

In none of the masculine exercises and the healthy sports of the field, have the fairer sex participated more than in falconry. In days of chivalry the ladies kept hawks, which were then as much caressed, by those who wished to obtain

¹⁸ Aves autem aucupio natas, accipitres videlicet, falcones, giro-falcos, peregrinos, montanos, gibbosos, astures, quos Pausanias astorgios vocat, quæ primus in Italiam longo postliminio Fredericus Ænobarbus advexit, ac cicures effici edocuit, primusque ex Italia Rainaldus marchio Estensis apud se in delitiis habuit, ad centum quinquaginta magnis expensis aluit. *Bandellus Dominicanus, Orat. Funebr. in Princip. Mantuanum.*

¹⁹ Reliqua Librorum Frederici II. Imperatoris de Arte Venandi cum Avibus, cum Manfredi Regis Additionibus;—ex membranis vetustis nunc primum edita. Albertus M. de falconibus, asturibus, et accipitribus. Augustæ Vindel. ad insigne pinus 1596, 414 pages 8vo.

²⁰ This work being extremely scarce, and having an opportunity to give some extracts, they may not be unacceptable. "The hood had its origin among the oriental nations; for the eastern Arabs used it more than any other people with whom we are acquainted, in taming falcons and birds of the same species. Some of the kings of Arabia sent to us the most expert falconers, with various kinds of falcons; and I did not fail, after I had resolved to collect into a book every thing respecting falconry, to invite from Arabia and every other country such as were most skilful in it; and I received from them the best information they could give. Because the use of the hood was one of the most effectual methods they knew for taming hawks, I had the benefit of it. I employed a hood in taming these birds; and it has been so much approved in Europe, that it is proper it should be handed down to posterity."

the favour of the fair, as are now their lap-dogs.²¹ Assuredly no amusement could be more conducive to the health of the frame, and, as far as that goes, towards procuring a healthy and vigorous mind, than exercises so replete with the comforts resulting from air and action, which so often awakened expectation, and had the pleasure so frequently to behold it gratified. But after the use of fire-arms had, in a manner, rendered falconry less general, the lovely sex could no more partake of those benefits which it conferred; because the use of arms is generally attended with alarm, and sometimes with danger.

Among the most ancient writers on falconry, we may consider Demetrius, about anno 1270, who was physician to the Emperor Michael Paleologus. His book, written in Greek, was first printed at Paris, in 1612, by Nicholas Rigaltius, from a MS. in the royal library, and was published, accompanied by a Latin translation of Peter Gyllius.²² Other works on the same subject, the antiquity of which is questioned, were printed at the same time. One in the dialect of Catalonia, has, it is said, the forged title of *Epistola Aquilæ, Symmachi et Theodotionis ad Ptolomæum Regem Ægypti de re accipitraria*. These writings treat chiefly of the rearing and diseases of hawks; and prescribe for cures, certain medicines, which, it is thought, would not now be given. Aloes, to the size of a bean, are recommended as a purge; and quicksilver for itch or breaking out. It is also said of an untractable falcon, that being confined some time with a hood in a smith's shop, the noise of the hammer tamed it. It appears, that *Thomas Brown* published, among certain miscellaneous tracts, in London, 8vo. 1684, a paper, *On Hawks and Falconry, ancient and modern*. But the best informed observations on falconry of a late date, we are told, are to be found in the work of that great master in the art, and of sporting in general, Colonel Thornton.²³ The *history* of this art we have above professed to deliver, and have collected the best materials we could procure for that purpose.

²¹ *Mémoires sur l'ancienne Chevalerie, par M. de la Curne de Sainte-Palaye*. Paris, 1759—1781, 3 vol. 12mo. tom. iii. p. 183. In this work are found many anecdotes of the taste of the French ladies for the sports of the field, in those heroic times.

²² Ἱερωνιστοφίων. Rei accipitrariæ scriptores nunc primum editi. Accessit Κύνιστοφίων, Liber de cura canum. Lutetiæ, 1612, 4to. Vide also *Fabricii Biblioth. Græca*, lib. i. cap. 25, vol. i. 155, where, it appears, the year 1619 is given wrong.

²³ We have heard this gentleman once observe, that he thought himself well qualified to teach the art.

FIRE-ESCAPES.

A fire-escape is a machine for escaping from windows when houses are on fire. Various machines to answer this purpose have been invented by different individuals. Much praise is unquestionably due to all who devise the means to ameliorate the sufferings of their species under any calamity: we cannot withhold our warm expressions of gratitude to all who endeavour to promote human good, nor can we sufficiently express our thanks to such as essay to prevent the occurrence of evil.

Thus we are disposed to eulogise those very laudable institutions, denominated *Assurance* or *Insurance* offices,¹ for saving harmless the sufferers, with respect to pecuniary loss, by the fatal raging, and the frightful mastery of the ignitious element. Should these be entitled to approbation on account of their providential benefits, no less are those ingenious individuals, who apply the purposes of mechanism to the very laudable view of saving life. Numerous have been the devices adopted for this humane purpose. Preference appears to have been given by a modern author,² to a machine invented by John Daniel Maseres, Esq. the description of which has been communicated to the world by B. M. Forster, Esq. published, with some improvements by himself, in the *Philosophical Magazine*: it is called “The Sling Fire-Escape.” We recapitulate the leading features, but cannot attain exactness, because we have not the benefit of a plate, to which occasional reference is necessary.

1. It seems it was effected by an iron suspended from a beam, constructed on a principle somewhat similar to, and terminating like that destructive instrument used in ancient warfare, called a *ram's-head*, and now applied to the more useful purpose of slinging goods from warehouse-doors; but, we understand, with this special difference from the last mentioned machine, that the bottom hooks are turned up to the upright part, to form two close rings, of $4\frac{1}{2}$ inches in thickness of the iron out of which it is hammered, to about half an inch.

2. There is a strong rope, made of flax, plaited in a peculiar manner, for which a patent was taken out by Armstrong, of St. John's Square, Clerkenwell, of about three-eighths of an inch in diameter; this rope, it is said, must be about twice the length of the distance from the window to the ground.

¹ First introduced under the reign of the Emperor Claudius.—*Nicholson*.

² Dr. Rees.

3. The member, called a regulator, is an oblong piece of beech-wood, $6\frac{1}{2}$ inches in length, $3\frac{1}{4}$ inches broad, about $\frac{7}{8}$ of an inch thick, in which there are four holes placed for the rope to pass through; one of these is open at the side; there is also a notch at the top of this piece of wood, and an oblong hole about $\frac{7}{8}$ of an inch from the bottom.

4. Another appendage is called an upper belt, which is a stout leathern strap, about 4 feet 3 inches long, $1\frac{1}{2}$ inch broad, with a buckle to it.

5. The lower belt is a strap also, of the same sort as the other; this is for the purpose of additional security, in case the tongue of the buckle should break by accident.

6. Another member is called an union strap, which is, we understand, so named, from its connecting the regulator to the other parts of the machine. This is leather, of about $1\frac{1}{2}$ foot long, and $1\frac{1}{4}$ inch broad; like the others it has a buckle to it. It is stained *black*, which colour serves to distinguish it from the other leathern straps.

The method of putting all those parts of the machine together, is first to pass one end of the rope through the holes in the regulator, then through the two lower rings in the suspension iron; the upper belt is then to be passed through a doubling of the union strap; after which the rope is then to be tied to that belt, and the knot secured by a string from slipping, (which string is to pass through two small holes in the leather,) and at about a foot below the rope, is to be tied to the lower belt in like manner; next, the union strap is to be put through the oblong hole in the regulator, and buckled, by which the upper belt and the regulator will be connected; the other end of the rope may be kept wound round a wooden roller, to prevent it from getting entangled.

Persons who purchase these machines should have a strong iron hook, with a spring catch, to fasten to some secure part of the window-frame or elsewhere; on this hook the suspension iron is to be hung by the upper ring, when any one wishes to descend from a window. The next operation is to step into the lower belt with both feet, and to draw it up sufficiently high, so as to form a kind of swing to sit in: the part of the strap which is through the hole, is to be laid hold of by the left-hand, and the buckle, with the right-hand, is to be slipped to its proper place, according to the size of the person; the tongue is then to be put into one of the holes, as in buckling common straps. After this is done, the upper belt is to be somewhat loosely buckled

round the chest, and then the rope, which is in the roller, is to be thrown out of the window to the ground.

Now all being ready for descending, the person is to get out of the window, grasping tight with one or both hands the rope at some convenient part, taking especial care not to meddle with the suspension iron, until quite out of the window; after which, the rope below the regulator is to be laid hold of with the right-hand, and to be let run through the holes as fast as there may be occasion; for which purpose, if necessary, it may be safely slipped out of the open hole, it will then have the check of only three holes; if the motion is wanted to be retarded, the rope is to be put into the notch at the upper part of the regulator. When one person has descended, and there is a necessity for a second immediately to follow, the union strap is to be then unbuckled, when the regulator will be separated from the upper belt; the belt may then be very easily drawn up, having the friction of the suspension iron only, and the person above is to put on the belt as before directed, and be let down gradually, partly by the one below, and partly by managing the rope as the other did; in this case, however, great care must be taken, as the check occasioned by the regulator is gone.

Observations and Cautions.—It is not easy to put down rules for what number of holes the rope must pass through, as this must be varied according to the weight of the person and other circumstances. It would be well, before the person gets out of the window, to examine first, (it is indeed absolutely necessary such investigation should be made,) whether the suspension iron is on the hook, then that the buckles are fast, the two knots tied, and that the rope is in the hole of the regulator, which has the opening; great care must be taken, that there is not any impediment to the free running of the rope, for which the wall of the house must be examined, and any nails or hooks which may chance to be there, removed: also iron scrapers, and any thing where the rope is likely to hitch.

Mr. Forster has, in some respects, simplified Mr. Masere's machine, particularly in substituting the ram-head suspension iron, in the place of a more complicated, and, in his opinion, less secure piece of mechanism. It consists of a solid piece of metal (in the latter improved ones) grooved cylinder, round which the rope is coiled two or three times, by which a considerable degree of the friction originally produced, is prevented, as well as the rapid descent which would otherwise happen. The metal cylinder is supported

on an iron frame, and suspended by a ring in the upper part of the frame, inclosing a grooved cylinder, and having a metal bar to hold the cheeks together.

Without any intention to deteriorate from the ingenuity of the above described machine, much less to undervalue the judgment of the learned gentleman who has given it a place in his valuable labours; we have seen a machine, more recently invented, which, in our humble judgment, infinitely surpasses Mr. Maseres' invention. And, we submit, it is to be considered superior; because its simplicity is so very evident. And also, because there are none of those intricate and tedious precautions necessary to be taken, which appear in the former machine to be essential; and really, at the time of such confusion, as is produced by a fire, these necessary precautions cannot be presumed to be attended to. Likewise, because of its superior accommodations.

The machine we now allude to, was an invention of Mr. Gregory, an ingenious practical mechanist, for which he obtained a patent in the course of the last year, 1818. It, to the best of our recollection, consisted of a strong wooden frame, about eight or nine feet long, and four feet high, supported upon two axle-trees, to which were attached four cast iron wheels; upon the top of this frame, were deposited three ladders, which were raised, so as for the lower end of the second to rest in a groove on the top of the first, and fastened together by strong iron hinges; and for the third to be in like manner raised to the top of the second, well secured by means of the strongest iron work. We regret that the exact mode of the construction of these joints, is not at present within our remembrance; but its general principles we perfectly recollect: these ladders were raised by means of two ropes, one end attached to the uppermost ladder, and the other to the beam of a windlass, which had a double handle. In the beams of the uppermost ladder were two pulleys, made of metal, a portion of which ropes beyond the pulleys, is fastened to a frame of strong wood or iron, of about four or five feet long, and three wide, to which frame is affixed strong netting, and which forms a very commodious cradle for the reception of two people, a very lusty person, or woman and child, &c. or for any who are sick or lame. This cradle is let down with expedition and ease, by means of the windlass, and raised as often as is necessary. It also is most convenient for people, whose fear might prevent their going upon ladders; or for those, the state of whose health would not permit them to trust themselves upon such unaccommodating means as the first described.

What, in our opinion, also renders this infinitely preferable is, that it can be placed as near to a house as may be necessary, is instantly put in motion by the assistance of two persons; and at fires it generally happens that there are always in populous towns, where fires are most to be dreaded, plenty of people to assist. The cradle, independent of the utility previously mentioned, will also contain property which no pecuniary means can replace, which may be brought down in the custody of the person to whom it is invaluable. For these reasons, and many others which will be apparent, we do not feel the slightest hesitation in giving our decided preference to Mr. Gregory's machine.

FORKS.

There is not the least room to suppose the ancients were at all acquainted with this little table utensil, as there is no expression in *Pliny*, who enumerated most things natural, physical, philosophical, and economical; nor does it occur in any other writer of antiquity; nor does *Pollux* speak of it in the very full catalogue which he has given of things necessary for a table.

Neither the Greeks or Romans had any name in the least applicable to its use, either direct, or by inference, where it can be asserted that such an instrument was named. The ancients had indeed in Greece their *κρεαγρα* *creagra*. In Rome their *furca*, *fuscina*, *furcilla*, *fuscinula*, and *gabalus*; the Grecian instrument, was, it is true, a fork, or perhaps somewhat resembling a rake of an ordinary construction, and calculated for the purpose of taking meat out of a boiling pot, constructed somewhat in the shape of a hook or rather the bent fingers of a hand; this, however, is the sense of a passage quoted by Suidas.¹

With reference to the Roman names previously given, the first two were undoubtedly applied to instruments which approached near to our furnace and hay forks. The trident of Neptune is also called *fuscina*. The *furcilla* was large enough to be employed as a weapon of defence, as is proved by accompanying expressions, as *furcillis ejicere* and *expellere*. *Fuscinula*, the present Latin name

¹ In the passage of Suidas which has this allusion, the word *σιδηροδακτυλος* denotes it.

for a table fork, is not to be found in any of the old Latin writers. The old translation of the Bible only explains the work *κρεαγγρα* by *fuscinaula*.

It is the opinion, we understand, of a learned Italian, that the ancient Romans used the instruments they called *ligulæ* instead of forks. Now these instruments had some distant resemblance to our *tea-spoons*. Hence we must conclude that they and our ancestors used no forks, because had they had any thing answering the purpose, even in effect, it must have had a name.

In the east we understand it was, and is still, customary to dress their victuals until it becomes so tender that they can easily pull it in pieces. We are told by modern travellers that if an animal be dressed before it has lost its natural warmth, it becomes tender and very savory. This is the oriental custom, and has been so from the most remote antiquity.

Formerly, all articles of food were cut up in small pieces before they were served up to table; the necessity for which practice will appear, when we remember they usually took their meals in a recumbent posture upon beds. Originally, for cutting meat, persons of rank kept an officer they called *scissor*, *carpus*, *carptor*; *Apuleius* calls him *diribitor*, who used a knife, the only one placed at the table, which, in opulent families had an ivory handle, and was ornamented with silver.

Their bread was never cut at table; it needed it not, being usually baked thin, somewhat resembling the passover cake of the Jews; this is not understood to have been universal notwithstanding.

The Chinese use no forks; however, to supply them, they have small sticks of ivory, often of very fine workmanship, inlaid with silver and gold, which each guest employs to pick up the bits of meat, it being previously divided. The invention of forks was not known two centuries ago in Europe, where people eat the same as they now do in Turkey.

In the NEW TESTAMENT² we read of putting hands into the dish. Homer also, in his 14th *Odyssey*, 453, and Ovid, in his *De Arte Amandi*, iii. v. 755, mention the same custom.

In the quotation from the sacred writings, we observe, that the guests had, it is presumed, no instrument to help

² Ὁ δὲ ἀποκριθεὶς, εἶπεν αὐτοῖς· Εἰς ἐκ τῶν δώδεκα ὁ ἐμβαπτόμενος μετ' ἐμὲ εἰς τὸ τραπέzion. St. Mark's Gospel, xiv. 20.

themselves out of the common dish which contained the repast; for, upon the question being put of who was to betray the Saviour, the answer is as given in the above quotation, "It is one of the twelve that dippeth with me in the dish."

In the passage cited from Homer, the phrase, according to the Latin translation, "*appositos manus porrigebant*," implies nearly the same sense. And had the Romans been apprised of the utility of this instrument, or in fact of any substitute, there could have been no occasion for the master of the amorous art to have given his instructions to his pupils in nearly similar terms which we now use to children.

*Carpe cibos digitis; est quiddam gestus edendi;
Ora nec immunda tota perunge manu.*

De Arte Amandi, iii. 755.

Although Count *Caylus*,³ and *Grignon*,⁴ both assert they have been found. The former says, one with two prongs was found among rubbish in the Appian Way, which he alleges to be of beautiful workmanship, terminating in the handle with a carved stag's foot. Notwithstanding the high reputation of that author, it is not generally credited. The latter says he discovered some in the ruins of a Roman town in Champagne; but he does not describe them, otherwise than to observe that one was of copper or brass, and the others of iron; and speaking of the latter, says, they appear to have been used as table forks, but were coarsely made.

The truth seems to be that *table forks* were first used in Italy, as appears from the book of *Galeotus Martius*, an Italian, in the service of Matthias Corvinus, King of Hungary, who reigned from 1458 to 1490. Martius relates that at that period forks were not used at table in Hungary, as in Italy, but that at meals each person laid hold of the meat with his fingers, and on that account they were much stained with saffron, usually put into sauces and soup. He praises the King for eating without a fork, yet conversing at the same time, and never dirtying his clothes.

In France, at the end of the sixteenth century, it appears, from a work before cited, *L'Isle des Hermaphrodites*,⁵ the author speaks of forks as being at that time quite unknown, even at the court of the monarch.

³ Recueil d'Antiquités, iii. p. 312. tab. lxxxiv. 5.

⁴ Bulletin des Fouilles, i. p. 17. ii. p. 131.

⁵ Published in 1724, at Cologne.

At about the same time they were not known in Sweden.⁶

From the history of the travels of our countryman *Coryate*, intituled *Crudities*, first published in 1611, and republished in 1776, the author says he first saw them in *Italy*, and he was also the first person who used them in *England*. As his account of them is curious, we may be excused giving an extract.

“ Here j will mention a thing that might have been
 “ spoken of before in discourse of the first Italian towne.
 “ J observed a custome in all those Italian cities and townes
 “ through the which j passed, that is not used in any other
 “ country that j saw in may travels, neither doe j thinke
 “ that any other nation of Christendome doth use it, but
 “ only Italy. The Italian, and also most strangers that are
 “ commorant in Italy, do alwaies at their meales use a
 “ little forke when they cut their meat. For while with
 “ their knife which they hold in one hand they cut the
 “ meate out of the dish, they fasten the forke, which they
 “ hold in their other hand, upon the same dish; so that
 “ whatsoever he be that sitting in the company of any
 “ others at meale, should unadvisedly touch the dish of
 “ meate with his fingers from which all at the table doe
 “ cut, he will give occasion of offence unto the company,
 “ as having transgressed the lawes of good manners, inso-
 “ much that for his error he shall be at least brow beaten
 “ if not reprehended in wordes. This forme of feeding
 “ j understand is generally used in all places of Italy;
 “ their forkes being for the most part made of yron or
 “ steele, and some of silver, but those are used only by
 “ Gentlemen. The reason of this their curiosity is, because
 “ the Italian cannot by any means indure to have his dish
 “ touched with fingers, seeing all men’s fingers are not
 “ alike cleane. Hereupon j myselfe thought good to imitate
 “ the Italian fashion by this forked cutting of meate, not
 “ only while j was in Italy, but also in Germany, and often-
 “ times in England since j came home, being once quipped
 “ for that frequent using of my forke by a certain learned
 “ Gentleman, a familiar friend of mine, one Mr. Laurence
 “ Whitaker, who in his merry humour doubted not to call
 “ me at table *furcifer*, only for using a forke at feeding,
 “ but for no other cause.”

In many parts of Spain, we understand that, *at present*,

⁶ Dalin Geschichte des Reiches Schweden, iii. 1. p. 401.

drinking-glasses, spoons, and forks are rarities.⁷ It is also said, that even in taverns, in many countries, particularly in France, knives are not placed on the table, because it is expected that each person should have one of his own. This custom the modern French appear to have derived from their ancestors the ancient Gauls. But as no person would eat any longer without forks, the landlords were obliged to furnish these, together with plates and spoons.

Among the highland Scotch, Dr. Johnson asserts, that knives have been introduced at table since the revolution only. Before that period the men usually cut their meat with a knife they carry as a companion to their dirk. The men cut the meat into small morsels for the women, who used their fingers to put it into their mouths.

The use of forks, at table, was at first considered as a superfluous luxury, and, as such, forbidden in convents, as appears from records of the congregation of St. Maur.

FOUNDLING HOSPITALS.

The dreadful crime of infanticide first suggested to the powerful, the wealthy, and humane, the idea of preventing, as far as it was possible, the commission of a guilt so unnatural, even to the feelings of the unfortunate author of the existence of the helpless little victim. In no nation or society on earth, ancient or modern, do we remember to have heard or read that the murder of unoffending infants has been permitted, or even sanctioned, except in a society which we have somewhere seen called *POLITE*!—among the *Chinese*, we mean, where the practice of child-murder is quite common. Upon the establishment of the French jesuit missionaries in that empire, those good religious men, viewing with natural horror this infernal practice, established a fund for providing for the reception of such infants as they could save. *De Pauw*, in his *Egypt* and *China*, who details this fact from the papers of that society, affords a lively picture of the state of the Chinese manners upon such occasions. We regret not having his valuable volumes before us, but think our recollection will serve us to supply a few principal facts. It should first be observed that polygamy is permitted in China. A Chinese first marries

⁷ Fischer's Reise nach Madrid, p. 238.

one woman, who is called HIS WIFE; he afterwards takes as many more women as he can afford to keep, which latter are denominated his LITTLE WIVES. That author observes, that among all the defects of the Chinese in the higher branches of mathematical learning, for which, by-the-bye, they are remarkable, none can better understand the principles of *common* or *shopkeepers' arithmetic* than they do. They calculate the expense of rearing and educating children, and then oppose to the amount, the value which such children will bring in the market, (as domestic slavery is also permitted by their laws.) Upon these sagacious *calculations* of profit and loss, they generally find that the expense is more to bring up a *female* than a *male* infant; and what further operates against the unfortunate females, they will not sell for *so much* money as the other sex: here are two weighty Chinese reasons why the poor girls should be barbarously murdered.

In China, positive infanticide, and what is worse, exposure, is nearly as general as nativities among the lower sort; the female sex being the chief sufferers! The midwives are generally the executioners, having water ready for the purpose, upon the moment the sex of the infant is discovered, the next instant it is plunged into and smothered in water. This should be regarded as really *humane* in the polished Chinese: for there are many children who meet with a still more horrible fate; for, notwithstanding this mode of private destruction is quite common, yet, to the best of our recollection, the midwives generally demand a small *douceur* for this practice; many, therefore, rather than pay this compliment, will have their infants thrown out upon the dunghill, or into the canals, common in the streets of China. Of such infants thrown upon land, the dogs, which run wild in large numbers, and also the swine, which are there plentiful, and also run common about the streets, mangle and devour the little innocents. But, notwithstanding all these numerous causes for infant destruction, the benevolent Frenchmen used to collect children to an average amount of, we think we shall not err, if we say 2000 per annum in the streets of *Pekin* alone!

Those ages we call barbarous among European and Asiatic nations, have generally either made laws against infanticide, or have provided for the protection of children exposed. Of most modern European nations, none is more famous for these provisions than the Russian empire. In its capital alone, there are many foundling hospitals. Indeed, it has had one of the most famous of its Empresses,

the consort of the greatest Russian chief, the eminent *Catharine*, wife of the Czar *Peter*, commonly called the Great, who was herself, if we do not greatly err in recollection, a foundling;¹ the gentleness of whose manners was alone qualified to sooth the too often barbarous temper of her spouse. In paroxysms of the most brutal passion would the great Peter listen to her gentle persuasions; like the music of the divine *Orpheus*, she alone could calm the raging and turbulent temper of his soul. And it is from hence, perhaps, we may infer the reason of the care the little unfortunates experience in that mighty empire.

In European societies boasting of civilization, and in the most civilized states, infanticide is generally the fate of the illegitimate. In such states it but too often happens that a young female, who has, perhaps, acquired from education the most delicate sense of honour and shame, finds herself, on the birth of an illegitimate child, exposed at once to the utmost disgrace and contempt. Her misfortune, though viewed with an eye of pity by the compassionate and worthy, excites the hatred of the greater part of her relations and friends, by whom she has been previously cherished, loved, and respected; and who exerted their utmost to endeavour to render her happy. The sudden change which internal consciousness tells her she may now expect in their behaviour, excites such a horror, on her part, at her past misconduct, that in a moment of the most dreadful agitation,—in a state of mind which borders upon despair and even madness, she commits the rash action of terminating the existence of the little helpless babe, just at the instant it inhaled the pure breath of heaven. She voluntarily sacrifices her future peace,—her prospective repose,—for what? why, for what could not be worth the purchase it will cost her. To preserve her reputation,—to avoid the deadly breath of slander,—the insults of the senseless, and the general opprobrium of a world deeper in iniquity than herself. Oh, could she but see with the calmer view of reason, it would convince her that, though she might by the rash action perhaps preserve her

¹ In P. J. Von Strahlenberg's History of the North of Europe and Asia, in his description of the manners of the Russians, c. v. § 7, we find the following observation: "It is well known that the Russian monarchs seldom marry foreign princesses, but on the contrary, choose one of their own subjects; and the Russian princesses have generally been married to Russian *Knieses*; occasioned partly on account of their religion, and partly on account of their having no great correspondence with other courts."

fame; yet the commission of that crime is seen by an eye, from whose piercing glance no secret can escape; it is also known to *herself*. Her heart in future moments of depression will upbraid her with the crime. She will endeavour, fruitlessly endeavour, to escape from the murderer of her child; but the bloody executor was herself. She may expect to find relief from change of place: but she never can escape the consciousness of her crime; the bloody spectre still will haunt her jocund days, her sleep, her sleepless nights, her morning of health, and her evening of indisposition!

These misfortunes of our species are among the disadvantages attending civilization, which, as society advances towards its apex, renders marriage more difficult as well as burdensome; and thereby the fear which naturally operates upon delicate minds of not being able to provide for the wants of an increased family, actually renders it impossible to gratify one of the most powerful impulses of our nature. In a savage state those delicate feelings are not found; the parents look for no more for themselves or children than what a generous Providence readily and unasked affords them with facility from day to day. This is the case with the natives of uncultivated wilds, where, perhaps, shell-fish, game, and esculent roots, liberally supply all the wants of nature. Here there is no concern for the maintenance of a child. But it is where civilization is advanced, and population increased to so great a degree, that no prospects are opened to the views of the miserable parent to make provision for his offspring; where either positive destruction, or apparent mendicity stares him in the face: that in a country like this last described, infanticide is most likely to abound.

Such was the dread of the serfs, or agricultural slaves of a district in Germany, where though the cruel and hard-hearted land-proprietor did not act in violation of the established laws, in *Büsch vom Geld-umlauf*. vi. 3. § 35, p. 393, we are informed, that in the course of nine years, not a single individual on those estates announced an intention of marrying; but the inhabitants had determined to bring no children to partake of the iron burden they themselves were compelled to bear; in consequence, a dearth of men ensued, and the proprietor was obliged to sell his estates. The purchaser improved the condition of his serfs, and marriages again became common among them.

In vain have legislators ever endeavoured to prevent this crime by capital punishment, more cruel than the crime

itself. It is indeed difficult, or rather impossible, for man to proportion punishment to delinquency, or the just degree of guilt. But, if legislators have tried in vain to check the accidents of humanity, to curb the cruel designs of the voluptuous, and to prevent the impulse of nature, it is in vain to look for a radical benefit, except from the result of a wise legislature, whose views are directed by benevolence.

However, to render this crime less frequent, to ease the dreadful apprehensions of compunctuous conscience, the practice of exposing infants in some public place was adopted, in the hope that some humane being might find the little helpless strangers, and would take care they should be educated and maintained. Parents thought, that since they were compelled to make the choice of one of the two evils, exposition to chance was less barbarous than positive murder. Hence, in all nations possessing natural feelings, this expedient has been universally adopted. With this view, choice has been made of market-places, temples, walls, the angle where two ways crossed each other, places resorted unto for bathing; even sometimes children were placed in the very water, but deposited in some little vessel or other, where they might be kept warm and at the same time dry. Such was the case of Moses; at the time the Egyptian monarch's cruel decree compelled the destruction of the Hebrew male children. The action of drawing up from the water is presumed to come from the imperative mood of the Hebrew verb נִגַּשׁ *niggash*, i. e. תִּנְגַּשְׁנָה *tenuggashnah*, *Ye women draw it out diligently.* “And the child grew, and she brought him unto *Pharaoh's* daughter, and he became her son, and she called his name Moses: and said, *because I drew him out of the water.*” *Exod. ii. 10.*

At *Athens*, children were commonly exposed in that place called *Cynosargēs*, which was one of the *gymnasia*. Such was the fate of the infant whom *Cerusa* bore to *Apollo*, as we are informed by *Euripides*.

Ως δ' ἦλθε χρόνος,
Τεκῆσ' ἐν οἴκοις παῖδ', ἀπηνεγκε βρέφος
Εἰς ταῦτόν ἄντρον, ἔπερ ἡνιάσθη θεῶ,
Κρέεσα· κακτίθουσιν ὡς θανέμενον
Κοίλης ἐν ἀντίπηγος εὐτρόχῳ κύκλῳ,
Προγόνων νόμον σῶζεσσα, τῆ τε γηγενῆς
Εριχδονίᾳ.

“The time she'd counted being expir'd,

“A boy, the produce of the stol'n embrace,

“ Which she expos’d in the same close recess,
 “ Where first the god had stol’n her maiden fruit ;
 “ In a round box, she there the infant left
 “ To perish, as the cruel ancient custom
 “ Was t’ have been experienc’d by *Erichthonius*.”

Potter’s Greece, Jon. act v. 15.

Instances without number occur in the Greek and Roman poets, of the practice of similar transactions, as well in their poets as historians ; Romulus and his brother having been exposed in the same manner on the banks of the Tyber, with this difference in the circumstance, that their uncle meant such exposition to have been their destruction. In the same manner did *Decreto*, the mother of Semiramis, expose her, whilst an infant, who was fed by means equally miraculous as was Romulus, as the story goes, which Diodorus records in the 1st chapter of his 2d book.²

At Rome, the usual place for exposition of infants, was the market for vegetables, by the column called *Columna Lactaria*; the name of which column implied its utility.

At length the practice had become so very common, that legislators took notice of it, and condemned the exposure as unlawful ; however, we find no measures taken to prevent a continuance of this practice until after the time of the first Christian Emperors. In their time even, the laws only endeavoured to render it less common, and their humanity taught them to provide for the maintenance of the children ;

² There is in Syria, a place called Ascalon, near which is a deep lake, abounding with fish ; not far off stands a temple dedicated to the famous Syrian goddess Decreto. She represents a woman in the face, and a fish in all other parts of her body ; which strange production is thus accounted for by some of the most judicious of the inhabitants of those parts : they say, that Venus, being angry with this goddess, caused her to fall into a vehement pang of love with a beautiful young man, who, among her worshippers, was sacrificing to her,—she was got with child by him, and delivered of a daughter ; being ashamed afterwards of what she had done, she killed the young man, and exposed the child among the rocks of the desert, and through sorrow and shame cast herself into the lake, and was afterwards transformed into a fish ; whence it came to pass, that at this very day, the Syrians eat no fish, but adore them as gods. They say that the infant so exposed, was preserved and nourished by a wonderful Providence, by means of a large flock of pigeons that nestled near where the young child lay ; for with their wings they cherished it and kept it warm ; observing when the herdsmen left their milk at the neighbouring cottages, took it up in their bills and brought it to the child, then thrust their beaks into its lips, and thus supported it for a year. When the child required stronger nourishment these little nurses, the pigeons, fed it with pieces of cheese, which they also took from the herdsmen ; who, observing their cheese plucked, they watched, and discovering the cause, found the child, who they presented to Sima, the King’s superintendent, who named her *Semiramis*, a name derived from pigeons in the Syrian tongue. Pigeons the Syrians afterwards adored as goddesses, &c.

until, at length, finding the evil daily increase, they declared it to be murder, without giving sufficient thought to the consequences of such an edict; for to them, the perpetrators, Dr. Garth's verse³ might with propriety be applied.

“ Frail nymphs oft by abortion aim,
“ To lose a substance, and preserve a name.”

And thereby the effect of infanticide and suicide was, doubtless often the consequence; or else it drove the unfortunate parent upon the certain commission of murder on her own offspring.

It should be remarked, that the humane *Tacitus* considered the ancient Germans as deviating from Roman manners, in their considering child-murder as a crime. And also where he speaks of the peculiarities of Jewish customs, he mentions the same thing. *Dionysius Halicarnassus* bestows a like praise upon the aborigines, for the same feeling.

We should have noticed that in all *Greece*, except at *Bæotian Thebes*,⁴ the exposure of children was permitted and very common; wherefore the historians mention the contrary as a foreign but notorious custom. *Strabo*,⁵ on this account praises the *Egyptians*, and *Ælian*⁶ eulogises the *Thebans*, whose laws were calculated to prevent the killing or exposure of children. *Romulus*, at *Rome*, endeavoured to restrain it; his order is found in the twelve tables of *Roman laws*: however, it is said as population, luxury, and scarcity increased, it had become customary for parents to expose such of their children as they could not maintain. Many deposited with them rings, jewels, robes, and other costly ornaments; and those who were poorer, things of little value, which were given, it is presumed to induce those who found them to be kind to them and to preserve them. This custom still remains in many places where children carried to foundling hospitals, are accompanied by tokens which are easily preserved; it is, we understand, the case at the *Spedale degl' Innocenti* of *Florence*,⁷ where a piece of lead is impressed by a number hung round the infant's neck, in such a manner that it may

³ Dispensary.

⁴ *Aristot. Polit. vii. p. 892.*

⁵ *Lib. xvii. p. 1180. edit. Amstel. 1707.*

⁶ *Variae Histor. ii. 7. p. 69.*

⁷ *Baldinger's Neues Magaz. für Aerzte, xii. 2. p. 154.*

not be easily removed, or occasion any inconvenience in wearing. By these means, information may be procured there at any period respecting the fate of children.

When human morals first experienced improvement, under the mild influence of Christianity, its disciples complained loudly of the cruelty of the Romans. The earliest Christian Emperors, however, did not, as we are informed, forbid it as a crime. Though *Constantine* called exposure a kind of murder, and very wisely exerted himself to remove the cause of it. By an edict, issued anno 331, he endeavoured to deter parents from it, as he thereby removed all hope of their being able to recover or reclaim exposed children, even should the parents make payment of the money expended in their bringing up. Notwithstanding this edict, or order, it did not remove the cause, as we discover from the writings of two authors in his reign, *Lactantius* and *Julius Firmicus*; the first describes it as a remnant of barbarity, and the latter, being a writer on judicial astrology, furnishes rules for casting the nativities of such children. The exposure of children was entirely prohibited by *Valentinian*, *Valens*, and *Gratian*, towards the close of the fourth century.

It must be mentioned, to the honour of many of the ancient states, that in such places the care of government was directed at an early period, to exposed children; not only were the means pursued in Greece and Rome to encourage the reception and education of exposed children, by assigning them as property to those who took them under their protection, but it was also made a law, that foundlings who were not received by private persons, should be educated at the public expense. At Thebes, for instance, as above noticed, to prevent child murder and exposure, it was ordained that parents, who could not afford to bring up their children, should carry their new-born babes to government, who committed them into the hands of those who engaged to take the best care of them for the least money. The only difference between the Theban customs and modern manners is, that the Theban children were slaves for life, whereas ours are free; or the manners of both were the same in other respects. The humane decrees of the Emperor *Constantine* merit particular attention in this place; the first for Italy, in 315; and second, for Africa, in 322. The governments in those countries were directed to prevent the murder, sale, or pawning of children, by supplying the parents with money to bring them up; which money was to be furnished by the public treasury or magazines, or from

the Emperor's privy purse, to provide food, clothing, and necessaries, and as new-born children required immediate attention, this was done without delay. This measure is thought to have been produced by the feeling manner in which *Lactantius*⁸ described the situation of parents to that Emperor. After these decrees, the children were nursed with their parents. But, it seems, there were in Athens as well as Rome, at a very early period, public receptacles for such children.

The Emperor Justinian, by a particular law, anno 529, declared foundlings to be free, denominating them *brephe-trophium*, from *βρεφος*, a child, and *τρεφο*, to educate, in his laws respecting them.

The institution of public receptacles for the reception of foundlings in latter ages, has been chiefly owing to the charitable donations of the piously disposed among private individuals.

The oldest establishment of this kind found in Germany, is one at *Triers*, founded in the latter part of the sixth century. Mention of it occurs in the life of a legendary saint, called *St. Goar*. The children so exposed here, were placed in a marble *conch* before the church-door.

In the seventh century, there were similar establishments at Anjou, or Angers, in France, by *St. Magnebodus*, Bishop of that place, subsequently called *St. Mainbeuf*, who had several houses built for their reception.

At Venice, there is also an institution for foundlings, called *Della Pieta*, established in 1380, by a Franciscan, named *Petruccio*.

In the year 787, an arch-priest, named *Datheus*, erected a foundling hospital, at *Milan*, at his own expense, purposely to stop child murder: in this house the infants received all necessaries till they were seven years old, when they were put out to learn some handicraft employment. It is said, that it was usual for the mothers of such children to strew salt between their clothes, which is said to intimate that the infant had not been baptized, or, perhaps, that it had not been purified by water.

There was established at Montpellier, in 1070, a religious order of the Holy Ghost, by *Oliver de la Trau*, the members

⁸ This writer wrote a book, in which he painted in glowing colours the misery and distress of poor parents; and he sagely advised the people not to beget *more children* than they could maintain. It has been thought this advice did not please the Emperor, who constantly wanted soldiers for his armies. So he seized the advantage of the writer's prudent advice to make the previous humane and providential regulation.

of which called themselves *hospitalarii, sive spiritus*: one object of their order was, generally to take care of the poor, and for such little exposed unfortunates to provide education and other necessaries. In a short time, this order spread itself into many countries, their object being the same. Among other places there was established a foundation in Rome; after confirmation by Pope Innocent III. in 1198, an elegant mansion was obtained for their establishment.

The house of Brunswick built a similar establishment at Einbeck, began by Duke Albert, in 1274. Alms were collected for its support, and patents granted; but this house was peculiar from others of the same kind, inasmuch as it provided for poor foreigners, as well as indigent natives; and received orphans and foundlings, for whom it provided till they grew up. An hospital, dedicated to the Holy Ghost, was built at Nuremberg, by a rich citizen, named *Conrad Heinz*, surnamed *der Grosse*, completed in 1341, for the reception of poor pregnant women, and the maintenance and education of their children. It was a rule in this house, that the day of the birth or reception of each child, should be recorded; so that, if it should ever have the ability to pay for the expenses it had incurred, a standard might be afforded to estimate the general charge.

In the same manner, pregnant females, both married as well as unmarried, were received in the Hospital of St. John, at Turin. A splendid hospital was founded in Florence, in 1316, called *Spedale degl' Innocenti*, by one *Pollini*. This is, it is presumed, the same establishment which the Camaldule monk, *Ambrosius*, often mentions under his family name *Traversari*; and support was solicited from the Pope for its maintenance as early as the beginning of the fifteenth century.

L'Hospital du S. Esprit, at Paris, was founded in 1362, and was supported by public voluntary contributions. A brotherhood, called *La Confrairie du S. Esprit*, was formed to conduct this institution; its charter and laws were confirmed by Pope Urban V.

Paris had, however, more institutions of that kind in the year 1638; a widow, whose name we regret the not being able to insert, devoted her house to the purpose of a *lying-in hospital*, whence it was called *La Maison de la Couche*, a name still retained by the French *Foundling Hospital* at the church of *Notre Dame*. It obtained new improvements from the Chancellor *Etienne d'Aligre*, and his lady *Elizabeth Luillier*; at present this house is known under the name of

L'Hospital des Enfants trouvés, or Notre Dame de la Misericorde.

In England there is a splendid hospital for foundlings, which was proposed to have been established seventeen years before it actually took place, from obstacles thrown in the way of the benevolent founder, *Captain Thomas Coram*, so that it was not founded until about the year 1739, or in the thirteenth year of King George II.

A lying-in hospital was also founded by her late Majesty, at Bayswater, near Tyburn-turnpike, and removed recently to Paddington; besides one instituted in the City-road as early as 1771. In the same road is also an Orphan Working School, for the support of necessitous children, established in 1773. An institution in Westminster-road, originally called the Westminster Lying-in Hospital, was founded in 1765. There is also a lying-in hospital in Brownlow-street, Drury-lane, which was founded in 1749, and licensed for the reception of pregnant women in the thirteenth year of the reign of his present Majesty, King George III.

In this land, where divine benevolence has peculiar pleasure, there have been established funds, repeatedly, for relieving poor women, when confined in child-bed, with medicines and suitable necessities for their situation, under the influence of many benevolent and noble personages.

To enumerate every charitable institution in London and its vicinity, would require many pages; want of room renders it impossible we can comply with our earnest desires.

GEOGRAPHY.

Geography is a science which treats of the situation, boundaries, extent, natural and political, or civil divisions of the earth; its name comes from *Γεο*, the earth, and *γραφια*, to measure, or delineate. The articles *tides*, *winds*, and *meteorology*, are likewise usually considered as component parts of this science. Geography is also considered as *ancient*, or that description of the earth generally known to antiquity; and *modern*, comprehending the latest discoveries, including the present political division of its surface into empires, kingdoms, republics, &c.

The first philosopher on record, who reduced geography to a science, was HIPPARCHUS, of *Alexandria*, who flourished between 160 and 125 years before Christ. He deter-

mined the latitude and longitude of place, and fixed the science upon certain and unerring principles, by his celestial observations: he also determined on the first degree of longitude, and fixed it at *Ferro*, one of the *Canaries*, where it has nearly ever since his time been calculated from; but of late years, geographers of different nations, have usually reckoned from the capitals of their respective native kingdoms.

The knowledge of geography in ancient days, was extremely circumscribed, until as late as the conquests of *Alexander*, who was careful to take with him on his oriental expedition, two men well skilled in all the learning of this science, which the times then afforded, *Diogenes* and *Beton*, who admeasured and delineated the progress of his army; they were also extremely careful to procure the best information which the natives of those countries, through which it passed, could render them. Not less careful was the next great conqueror, the imperial *Cæsar*, and succeeding Roman commanders, in this respect, for they had delineated the various kingdoms and provinces they subjugated, with an exactness which astonishes modern geographers. They used regularly to delineate the countries over which the Roman eagle flew, on maps, which they ornamented with the representations of the natives of the various countries, in their several costumes. This representation formed a portion of their procession on the return of the commanders in triumphal entry into the city of Rome. They also exhibited draughts of these figures on their theatrical scenery¹ or purple curtains, (*intexti*,) which, on the Roman stage, contrary to our custom, were to be raised (*tolli*) from the flooring to the roof, where the figures appeared to rise gradually with the curtain, as is beautifully described by Ovid.² Whence the *Britons*, after the Roman conquest of the country, were said to raise their curtains.³ It has been also conceived possible, that some captives or slaves of this people were employed for that purpose; for in the opinion of Servius, the words of Virgil will admit of both interpretations. These circumstances are mentioned purposely to show the trouble the ancient conquerors took to preserve every thing which would serve to illustrate the history of the people they had subdued; and, at the same time, to preserve every vestige of the geography of its districts, its rivers, towns, shores, &c. were all accurately surveyed and correctly delineated, as previously noticed. Before the con-

¹ Virgil's Georg. iii. 25.

² Ovid's Met. iii. 3.

³ Virgil, *ibidem*.

quests of Alexander and those of Cæsar, the inhabitants of the world were extremely ignorant of its geography, as we have seen in a former article.

Bockart's Sacred Geography, the History of the Alexandrine Conquests by *Ctesias*, Arrian *De Expedit. Alexandri.* and the Roman *Itinerary*, furnish the best ideas of the geographical knowledge of the ancients.

The best and most approved geographical works of the moderns, are those of Mons. *D'Anville*, undertaken with a view to ascertain the geography of the ancients, and to reconcile ancient with modern nomenclature. That of Major *Rennell*, who had for his object to establish the geographical notices of *Herodotus*. Mons. *Humboldt*, J. De Costa's History of America and the Indies, L'Abbe Raynall's geographical labours, particularly with respect to the interior of America. The travels of *Bruce* into Abyssinia: of Mungo Parke into the interior of Africa. Peter John Von Strahlenberg's Historio-Geographical Description of the North and North-East Parts of Europe and Asia. The histories of the conquests of Zingis Khan, and of Tamerlane, Bajazet, &c. with regard to Chinese Tartary, Great Tartary, Crim Tartary, and other large Asiatic districts. And the great learning displayed by *D. Macpherson*, in his geographical labours, is exhibited in the ancient maps which ornament that great monument of human industry, the *Cyclopædia* of the learned Dr. Rees. The voyages of Captains *Cook*, *Vancouver*, and other celebrated navigators.

With regard to Africa, the moderns are, perhaps, less acquainted with that vast country (if knowledge of its courts be excepted) than were the ancient Romans, who had colonies in many of its provinces, especially to the north, Utica, the kingdom of ancient Carthage, Numidia, &c.

The usual divisions of the globe into geographical proportion, are made as hath been suggested by *nature*, which divides the earth into water and land; the former consisting of oceans, seas, gulphs, straits, lakes, creeks, and rivers; and the latter into continents, islands, headlands, isthmuses, promontories, capes, and necks: each of the preceding being answerable, in point of natural shape, unto the other: and *civilly* or *politically* into those divisions which the necessities, the wants, or the policy of man may have induced him to consider it, as into empires, kingdoms, republics, states, principalities, provinces, counties, &c.

The earth is further distinguished into the following generally recognised denominations: mountains, primary and secondary; hills, valleys, plains, champaigns, levels, flats,

lowlands, and others, answerable to various local denominations.

Rivers are generally found to be proceeding from rivulets, these draw their being from brooks; whilst those come from springs, which usually have their origin in some mountain or hill, which having arrested the progress of the clouds and aqueous vapour in the air, originally produce them. Thus nature answering one part unto another, is carried on with a simple undeviating harmony, which is conducive to the general concord of the whole system; and evinces the wonderful providence of its Almighty architect.

With regard to those parts of geography, usually regulated by astronomy, the sphere, or globe, is first divided into two equal parts, called hemispheres, by a central belt called the *equator*; it is also called the *equinoctial line*, because when the sun moves in it, which it does twice in the year, equal day and night prevail all over the world. At the distance of $23\frac{1}{2}^{\circ}$ from the equator, on either side, are two other imaginary lines, called tropics, that on the north is called the tropic of *Cancer*, and that on the south the tropic of *Capricorn*: the space between them is called the *torrid zone*. $23\frac{1}{2}^{\circ}$ from the north and south poles there are two other circles, called the *arctic circle* at the northern, and *antarctic circle* at the southern extremity; the spaces between these circles and the poles are called the *frigid* or *frozen zones*; whilst the intermediate spaces between those circles on each side of the equator, and the arctic and antarctic circles, are known as the *temperate zones*.

Taking the globe from north to south, it is divided into four quadrants of 90° each, amounting to 360° . Whilst taking each of the oriental and occidental hemispheres, it is also reckoned to contain 180° each, amounting to a similar number, or 360° . The sun is constantly vertical over some part of the torrid zone; its *course* is called the *ecliptic*; it crosses the line twice in the year. From natural causes, *i. e.* *heat*, at the equator and within the torrid zone, the bulk of the earth is increased; whilst within the frigid zones, from intensity of *cold*, it vanishes out of, or recedes from, or as is occasionally said, is evanescent out of a regular circle; whence its form is not perfectly round, but *elliptical*.

The dimension of each degree, taken north and south, as well as east and west, is commonly calculated at $60\frac{1}{2}$ geographical miles.

GOLD VARNISH.

A method to obtain the appearance of gold at a small expense, is called varnishing. All men, desirous of having furniture of the appearance of gold, could not afford that valuable and noble metal; therefore some expedient was necessary to procure this at a moderate charge. At first gold was, as it now is, hammered into thin plates or leaves; and those articles covered with it.¹ But as this method of gilding was also found expensive, notwithstanding the extreme ductile nature of that metal, and its almost infinite divisibility, as has been shown in a former article; yet, as the ancients were not so well acquainted with its properties as are the moderns; also considering that the metal thus employed was lost; the colours most resembling gold were then tried: but as in every case these could not answer, an idea was in time suggested of overlaying with silver, or some cheaper metal, such things to which they wished to give the appearance of gold, and then covering it with a yellow transparent varnish, in order that the varnish and metal might assist each other reciprocally in producing an effect as nearly similar to gold as could be. *Seneca*, speaking of gilding, says, “When we cover our houses with gold, do we not show that we delight in deception? for we know that coarse wood is concealed under that gold.”

The ingenious process which is employed all over Europe in gilding wooden frames, coaches, and other articles, not made of metal, also for the manufacture of leather tapestry, was invented towards the close of the seventeenth century. We understand that *Anderson*, in his *Historical and Chronological deductions of the History of Commerce*, alleges that it was first introduced into England by one *Evelyn*, in the year 1633; and he adduces for proof, the present State of England, printed in the year 1683.

An author, to whom we have been much obliged, in our opinion, rudely objects at once to this passage of our commercial historian, and without the least preparatory apology, breaks upon us by roundly asserting,—“This

¹ Vide *Homer's Odyssey*, lib. iii. v. 432. It is presumed, that with metal so prepared, the horns of ancient sacrifices were ornamented; so were the horns of the cow, which Nestor brought as an offering to Minerva, decorated. Also the Lacedæmonians being directed by the oracle to gild the face of the statue of Apollo, they inquired where they could procure so much gold, and were directed to *Cæsus*, King of Lydia.

invention, however, does not belong to the English; surely he might have waited till they had claimed it. But that they did no such thing, the very words of the author he quotes would convince him, who only says "it was *introduced* into England by one Evelyn, in the year 1633." We are desirous that all should have that which is their due; and we accordingly find it is claimed by the *Sicilians*. One *Antonio Cento*, an artist of Palermo, first discovered the gold varnish, and about 1680 the method of preparing it was published, which will be discovered in a book, intituled *La Sicilia inventrice; overo, Le invenzione lodevoli nate in Sicilia, opera del Dottor. D. Vincenzo Auria, Palermitano: con li divertimenti geniali, osservazioni e giunte all' istessa, di D. Antonio Mongitore, sacerdote Palermitano.* Palermo, 1704, 4to.

Among other things, it contains the following: "Take gum lac, it being freed from all filth, with which it is usually mixed, put it in linen, wash it with pure water, till it has ceased to give the water a red tint; then, after it is dried perfectly, reduce it to an impalpable powder; to every pound of this powder add four pounds of spirit of wine; mix these well together, then pour them into an alembic, graduate the fire so as for it perfectly to dissolve the gum in the spirit; then strain this solution through a piece of fine linen cloth, the refuse that remains in the cloth being well pressed, may be thrown away; cork it closely in a glass bottle. With this solution any wood may be gilt. Taking care to use it with a smooth tool, being a pencil made from the tail of a certain quadruped, called the *vari*, to be had in the colour-shops; with this liquor wash the wood, prepared with silver, three times gently over, suffering it to dry between each washing. By these means your work will be extremely beautiful, and have a resemblance to the finest gold."

This recipe is often varied by different workmen, who do each of them pretend to have some peculiar addition of their own, to improve it; they accordingly preserve them as a profound secret; but the above is the basis of the composition, with a correct detail of the process, used in making and applying of it. Reaumur was apprised, as has been discovered from his papers, of the gilding of leather tapestry; and, it is also said, the method of making the English varnish was communicated by Scarlet to Hellot, anno 1720; and by Graham to Du Fay, in 1738. In 1761, Hellot gave the recipe to the Academy of Sciences at Paris, who published it the same year. See their *Memoirs*.

GILDING.

Some workmen denominate dry gilding “*The light method.*” It is presumed to be an invention for which we are indebted to Germany. In the Philosophical Transactions for 1698, Robert Southwell, who made the communication, declares that its process was known to very few goldsmiths in Germany.

It is performed by steeping linen rags in a solution of gold; then burning them; and with a piece of cloth saturated in salt-water, rubbing the ashes of those rags over the silver intended to be gilt. This process does not require much labour or much gold; and it may be advantageously employed for all ornamental and carved work. But it unfortunately is not durable.

GUNS, GUN LOCKS, BARRELS, &c.

That these destructive instruments were not known until since the introduction of gunpowder into Europe, may be inferred, since consistent with our former principles, and those which direct the species, their *necessity* or *utility* could not require a posterior existence, may, we think, be safely concluded.

At first, the construction of this machine was characterized by that awkward, rude, and cumbersome appearance which generally distinguished all inventions in their infancy; reminding us of those very rude implements brought from the Sandwich islands, and deposited in our Museum.

The first portable fire-arms were discharged by a match; in course of time, this was fastened to a cock for the greater security of the hand whilst discharging the piece. Afterwards a fire-stone was added, screwed into a cock, with a steel-plate before it, and fixed in a small wheel, which could be wound up by a particular key affixed to the barrel. This fire-stone was not at first of a vitreous nature, like that now in use for striking fire, but a compact *pyrites*, or *marcasite*, long known as such, and called a *fire-stone*. As an instrument so furnished was often liable to miss fire, till a late period a match was still continued with the wheel; and it was not until a considerable time after that instead of a friable *pyrites*, so much exposed to

effloresce, a vitreous stone was affixed to the improvement of the lock, somewhat resembling our gun-lock. But these progressive improvements advanced slowly, because as recently as the early part of the last century these clumsy contrivances were in use. During that period, those instruments were denominated by various names, chiefly German and Dutch, such as *büchse*, *hakenbüchse*, *arquebuse*; musket, martinet, pistol, *flinte*, &c. Those who may be desirous of other names, and further particulars, are respectfully referred to *Grose's Military Antiquities*. It is said, the first name arose from the oldest portable kind of fire-arms having a similarity to a box. There were long and short *büchse*, the latter of which, as we have been informed from *Hortleder*, were peculiar to cavalry; the longest kind, also, from their resemblance to a pipe, were called in Germany *rohr*.

Large pieces, which were conveyed on carriages, were called *Karrenbüchse*, from the action of conveyance. Soon afterwards cannon were also introduced, at first called *canna*; now known as artillery. However, artillery-men, arsenal-men, and others concerned in those employments, still use the terms previously mentioned. The *hakenbüchsen* were so very large and heavy, that if carried in the hand they could not be manually used alone; they were therefore supported by a post or stay, called a *bock*, because it had a forked end, somewhat rudely resembling the horns of that animal, the buck, between which the piece was fixed by a hook projecting from the stock; figures of which parts, as well as their utility, may be found in the French work *Histoire de la Milice François, par Daniel, 1724, 4to.* There is still preserved an old *büchse* in the Tower of London, where every species of our national arms are preserved.¹

From those terms before mentioned, it should appear, that not only the French, but also the English, and most other European nations took the names of their fire-arms.

The *hakenbüchsen*, is said to have been a German invention of the beginning of the sixteenth century. *Daniel*, we understand, says, “ *Fabrice Colonne dans les ‘ Dialogues de Machiavel sur l’art de la guerre, parle de cette arme comme d’une invention nouvelle et de son tems.’ L’arquebuse, dit il, qui est un bâton inventé de nouveau, comme vous sçavez, est bien nécessaire pour le tems qui court. L’auteur de la Discipline militaire, attribué au Seigneur de Langei, en parle de même; la harquebuse, dit il, a été trouvée de peu d’ans en ça,*

¹ See also in *Grose's Military Antiquities*.

et est très-bonne. Il écrivoit sous le regne de François I. Si nous en croyons Luigi-Collado dans son Traité de l'Artillerie, imprimé à Venise, l'an 1586, on ne commença que de son tems à se servir des arquebuses à roüet en Allemagne. Nell' Allemagna etiandio fu ritrovata l'inventionone de gl' Archibugi da ruoto." This is assuredly confirmed by the testimony of *Martin Bellay*, who, speaking of the league formed between the Emperor Charles V. and Pope Leo X. against France, and the siege of Parma undertaken in the year 1521, says, "*De ceste heure là furent inventées les harcquebouzes qu'on tiroit sur une fourchette.*"

It appears, likewise, that *pistols* with a wheel, were used earlier in Germany than in France. *Bellay* mentions them in the year 1544, in the time of Francis I. and under Henry II. the German horsemen, *des reiters*, were called *pistoliers*. *De la Noue*, who served under both kings, has told us, in his *Discours Politiques et Militaires*, that the Germans first employed pistols. *Frisch* conjectures this name is derived from *pistillo*, or *stiopo*, because pistols used to have large knobs on the handle. *Daniel* and others think, with more probability, that the name came from Pistoia in Tuscany, because there they were first made and provided; and if we might hazard an opinion, we add, we think his conjecture right. Hence, although Germany might first have generally used them, as may appear, we think they were an *Italian* invention.

Muskets are said to have received their name from either the French *mouchet*, or else from the Latin *muschetus*; however, we shall hazard an opinion, which may be found, perhaps, entitled to some respect, when we say, we believe neither of these terms gave its original, and submit that we conceive it came from the Latin *muscarium*; the fall of men, being as sudden after the explosion, as the death of a fly, after it is flapped by that instrument, as common in butcher's shambles in ancient Rome as at those of our butchers.

Daniel proves they were known in France as early as the period of Francis I. *Brantome*, however, asserts they were introduced by the Duke of Alva; that cruel monster, that tool of a blood-thirsty tyrant, whose name has its merit when it has eternal execration,—as the exploits of that diabolical character in the Spanish Netherlands bear indubitable testimony: that wretch existed in 1507; and that they were not known in France at that period, as the last named author proves, or rather asserts, in another place; where he also says, they were first made known in France by

M. de Strozzi, under Charles XI. What credit is due to him we pretend not to determine.

The lock is said to have been invented in the city of *Nuremberg*, in Germany, about 1517, as many bear testimony; but that cannot be considered of the lock in its present improved state. Besides, the *fire-lock* is commonly known by the name of the *French lock*, even in Germany; which certainly militates against the previous assertion, the one giving the name, perhaps, to the other. *Beckmann*, still sticking for the honour of the invention for his countrymen, afterwards asserts that though the lock might have been invented in Germany, he conceives the improvements of it might have been subsequently made in France.

The same author says, "In the History of the Brunswick military, it is stated that the soldiers of that duchy first obtained, in 1687, flint-locks instead of match-locks. It has often been asserted," he continues, "that fire-tubes, which took fire of themselves, were forbidden first in Bohemia and Moravia, and afterwards in the whole German empire, under a severe penalty, by the Emperor *Maximilian I.*; but I have not found any allusion to this circumstance in the different police laws of that Emperor."

That the first fire-stones were pyrites, appears from various sources: see the second part of *Samlung der Reichsabschiede*, Frankfort on the Maine, 1747. fol.; and afterwards a vitreous kind of stone was introduced in its stead; this circumstance, is said, to have produced some kind of confusion: instances are said to be produced by *Henkel*, so that many applied to that stone what was related by the Germans of antiquity as concerning pyrites. In the greater part of Europe, people use at present that *hornstein*,² called by *Wallerius*, *silex igniarius*, and by *Linnæus*, *silex cretaceus*. In Germany, it is said, it was originally *flins* or *vlins*, which latter word is thought most proper; in Sweden, Denmark, and England, its name is *flinta* and *flint*. This appellation is of great antiquity. The *Wends* had a pagan deity of that name, whose statue was anciently, by northern nations, erected upon a stone called *flynstein*.

Anciently, in Germany, as it appears from the song of

² Not every where, for it appears, that in Tyrol, the hardest ferruginous granite, consisting of corneous, partly irregular and in part polyhedral pieces, is employed for the same purpose as flints are in England and Germany, and which are from thence called Tyrol flints. Jasper, ground sharp, is employed for the same purpose in Turkey,

Hildebrand, a metrical romance of a very early date, that Hildebrand and Hudebrand, a father and son, and at that moment ignorant of their near affinity, agreed to fight for each other's armour; and it is said, "They let fly their ashen spears with such force, that they stuck in the shields, and they thrust resounding axes of *flint* against each other, having uplifted their shields previously; but the Lady Utta rushed in between them, '*I know the cross of gold,*' said she, '*which I gave him for his shield; this is my Hildebrand. You, Hudebrand, sheath your sword, this is your father!*' Then she led both champions into the hall, and gave them meat and wine with many embraces."

Besides these proofs that the ancient name of this vitreous stone was known in Germany by the name of *vlint*; which species of stone may, perhaps, without hazarding the danger of error, be conceived to be the same which *Zipporah*, the wife of *Moses*, is represented to have used in the 25th verse of the 4th chapter of Exodus: "Then *Zipporah* took a *sharp stone*, and cut off the foreskin of her son, and cast it at his feet, and said, Surely a bloody husband art thou to me." And it is added, she said so on account of the circumcision.

In addition to what has appeared, let us add, it cannot be doubted that the instrument fired by this stone, first obtained from it in Germany, the name of *flintgewehr*, *vlint*, or *flinte*; as the ancient name of *vlint* may in general be now lost, it is now commonly called, from the weapon, *flint-stone*. Those people acquainted with the northern, Scandinavian, and German antiquities, know that the knives employed in ancient sacrifices, and other sharp articles, were made of this stone, as appears from the remains being yet discovered in old barrows and between urns. This proves that these stones were much used by the ancients.

It is also presumed that the *Ethiopian stone*, mentioned by *Diodorus Siculus*, as used by the *Paraschite*, one of the Egyptian embalmers, first to open the body to get at the intestines, was a *flint-stone*. The soil being in some places siliceous, or chalky, naturally produce such stones in common with that earth.

The flint is a stone indigenous in most European countries; they are commonly collected and also manufactured by shepherds and others who have much spare time. The easiest mode to shape them is with a species of pillow of saw-dust, or some other soft material sown up in coarse

hemp or woollen cloth, held upon the knees, and with a hammer having a bevil edge, they may be broken into almost any form or size by those accustomed to the practice.

The great variety of the material from whence they are composed, allows for any waste which accident may produce. In Oxfordshire, Berkshire, Kent, Wiltshire, and all chalk districts in England, they are so plentiful, that they are the common material employed for mending the public roads. But we are informed that this not the case in France; where in time of war the people are prohibited from exporting them. The Dutch are commonly large dealers in that article.

Flint is a large component, indeed the staple, in the manufacture of glass.

Savary relates that the largest quantity and best stones produced in France, come from Berry. Many are also produced from *Stevensklint*, in Zealand, as we are informed by Professor Beckmann.³

HERALDRY.

We propose to include in whatever we have to say on this head, as well the art of armoury, and emblazoning coats of arms, as the office of an herald. And first of *armorial bearings*. It has been adduced, we know, to an Egyptian origin: being traced by a contemporary¹ to the expedition of *Osiris*, where Diodorus Siculus says, the sons of that prince Annubis and Macedo accompanied their father, dressed, or armed in coats of mail, having resemblance to such animals as those young princes themselves were said to assimilate to in the disposition of their minds. Annubis was covered with a dog's skin, whilst Macedo wore that of a wolf.

But we think we can carry it to about a couple of ages before the period of that expedition, and submit that we suggest, perhaps, a more satisfactory and probable occasion. The circumstance to which we allude, is detailed in the 49th chapter of Genesis, when Jacob, immediately previous to his death, recounts the chief actions which had distinguished his children. Reuben was remarkable for unsteadiness, therefore *water* was thought a proper type to personate that character. Simeon and Levi were cruel, represented by instruments of cruelty. Judah's type was a

³ Vol. iv. p. 613.

¹ Dr. Rees,

young lion,—alluding to the excellency and nobility of his disposition: the sceptre was another symbol which distinguished the same person. Zebulun was known by a ship; his residence was declared to be by a haven of the sea. Isachar was represented by a strong ass couching between two burdens. Dan was made eminent by the insignia of justice and legislation, quartered with a serpent, the emblem of fecundity, but in this instance of cunning. Gad was personified by instruments of warfare; because, it was declared himself and descendants should be concerned in warlike enterprises. Asher was figuratively designated by fertility. Naphtali was represented by a hind enjoying freedom: as was also Joseph by a branch laden with fruits. The symbol of Benjamin was a wolf rending its spoil.

Such various devices as we have enumerated, we are told distinguished the banners of those patriarchal families. If the Talmudist and Jewish traditions are correct, this is unquestionably the oldest record we have of armorial bearings. Among various nations, and particularly it was usual among all warlike people to bear arms. It is said, the chief vessel of the Argonautic expedition was ornamented by a yellow fleece, as the insignia of its commander. It is also alleged that the armorial bearing of Bellerophon was a winged Pegasus. The ensign of imperial Rome was an eagle. In Rome, we are also told, there was established a college of arms. It is very evident, from that rare and elegant specimen of Latinity which we have of Tacitus, in *De Mor. Germanicæ*, who definitely and distinctly assures us, in enumerating the warlike instruments of that people, that the cavalry had nothing but a *framea*, a species of javelin. The infantry, of which their greatest force consisted, had also missive weapons, of each a certain number, which they threw to an immense distance. They were either naked, or dressed in a light mantle, *sagulo leves*. A German paid no attention to dress, “*but decorated his shield with the choicest colours*.”

Although this last instance adduced, alludes to emblazoning the shield, it certainly has no reference to the signs with which a shield is charged; nor, indeed, has the former any relation to other bearings than what may be said to distinguish nations, there being nothing characteristic of those specific bearings which are now known as serving to distinguish families of honourable descent from the ignoble, or to discriminate different individuals. This species of honourable distinction, it is conjectured, had its origin in Germany, about the period of the Crusades.

Therefore, from such records to which we have access, we state, that heraldry, according to its modern acceptation, is considered as the science of armouries and their blazons, as it first drew its origin from the honourable profession of arms; so it comprehends the knowledge which relates to the several military marks of honour and dignity, borne upon shields, ensigns, crests, surcoats, &c. which have been assumed by sovereigns, appropriated to communities and high offices, or according to the laws of arms have been either taken, and authorised to be retained, or originally granted by potentates, or such as they have duly authorised for that purpose, as hereditary tokens, by which families and persons of ancient and worthy descent, are illustrated, distinguished, and known from the ignoble, common, and base, who are not entitled to such honour and respect.

It is generally believed that the practice of armorial bearing was introduced into Europe at about the period of the Crusades, from the practice of wearing banners in the field of battle to distinguish persons, which were usually painted upon the surcoat, whereby not only families were known, but also individuals were distinguished, and their glorious exploits made visible to every eye, by such devices.

Few subjects have engaged so much attention, or led to a greater variety of opinion, as well respecting its origin, as also regarding the import of the intentional resemblances of its figures. It has been handled by pens well qualified to treat of the subject, as will appear from those names after to be mentioned. It seems to have been the opinion of CAMDEN, that arms were originally borne at the period we have mentioned, the time of the Crusades; and such bearings as were then adopted, by little and little became hereditary; when it was accounted an especial honour to posterity to retain those arms which had been displayed in the holy service against the professed enemies of Christianity; he concludes, that we received, at that time, the hereditary use of them; but that the same were not fully established until the reign of Henry III.; for that in the instances of the last Earls of Chester, the two Quincies, Earls of Winchester, and the two Lacies, Earls of Lincoln, the arms of the father still varied from those of the son.

Although it should seem that Sir Henry Spelman is of opinion, that they are of still more modern growth in this kingdom; for speaking of the antiquity generally allowed to the usage of arms in England, he observes, "this nation being for some hundreds of years harassed with wars in the storms of foreign assaults and civil commotions, there is

little reason to be over confident in matters of pedigree and arms beyond 400 years," from his time; and he even expresses his doubt, whether they are entitled to that antiquity, by adding, "*Nescio an ea profus antiquitate.*"

Herald.—Because we shall unavoidably perceive more of the antiquity of "*armorial bearings*" under this consideration, we now enter upon this part of our subject. The antiquity of this officer, is indeed very remote in most nations of the earth. In the theology of the ancient world it appears, for as such is Mercury to be regarded to Jupiter, Isis to Juno, &c. That beautiful and deathless poem, the *Iliad*, opens with a priest assuming that character from a god to the sovereigns of united Greece. Chryses, the father of Chryseïs, a beautiful female, whom Agamemnon had received as his share of the plunder of Chrysa, a neighbouring town, appears to implore the restoration of his lost, his darling child; ornamented with the insignia of his deity, a golden sceptre and a laurel crown.

" Suppliant the venerable father stands,
 " Apollo's awful ensigns grace his hands;
 " By these he begs, and lowly bending down,
 " Extends the sceptre and the laurel crown.
 " He sued to all, but chief implor'd for grace
 " The brother kings, of Atreus' royal race."

POPE, *Il. i. l. 13.*

Stentor, whose voice was of strength equal to those of fifty men together, is said to have been the herald of the united Grecians. Talthybius appears to have been the special herald of Agamemnon, and as such we perceive him engaged in fetching the lamb for a sacrifice to Jupiter, on the first truce between the belligerent forces.

" Talthybius hastens to the fleet to bring
 " The lamb for Jove, th' inviolable king."

POPE, *Il. iii. l. 163.*

The antiquity of this office is unquestionable; it is presumed that it had being coeval with the original association of mankind, and is equally as ancient as governments; as the proper appendage to sovereign authority. In Greece, in particular, very frequent mention is made of them; as we perceive in *Homer*, that amidst the din of contending armies their persons were regarded as sacred, being the ministers of peace, as well as the harbingers of war. This sacredness of their persons the poet often expresses in similar terms to "sacred to gods and men." They were the first lawfully constituted ambassadors, whence

some modern etymologists have derived the name of this office, as *Du Cange* says our term comes from the Saxon *here*, or German *heir*, army, and *ald*, servant; because chiefly serving in the army. Others will have the two words, thus compounded, to imply *champion of the army*; because of their office in denouncing war or proclaiming peace, &c. *Du Cange* adds, they were originally called also *clarigarii*, as well as heralds. *Borel*, we are told, derives the word from the Latin *herus*, master, *q. d.* high lord; others from *herold*, which is the same with *Dominus vetranus*; and others, lastly, from *hea*, master, or army, and *hold*, *q. d.* bound to his lord, or the army. See *Edmondson's* complete Body of Heraldry, vol. i. p. 81—83.

The Greek name for the office was *κηρυκες*, and *ειρηνοφυλκος*: the Romans called them *feciales*. It appears that the last-named people had a college of heralds, appointed to decide whether a war was just or unjust; and to prevent its coming to open hostilities, till all means had been used for the decision of the difference in a pacific way.

Æneas Sylvius, in an epistle, written anno 1451, refers to a MS. about heralds, which he had seen in St. Paul's church, London, compiled, as he asserts, about 600 years before that time: if the alleged antiquity of such MS. be admitted, the office was recognised in this kingdom as early as the year 851, which would serve to vindicate the long suspected genuineness of the statute about tournaments, said to have been made by the Emperor Henry I. in the year 938, in which are mentioned kings of arms, heralds, and their respective duties. But, it is said, Sir Henry Spelman hath proved that this MS. ought to be referred to the time of the Emperor Charles IV. and not to that of Charlemagne, when *Æneas Sylvius* imagined it to have been written. *Mutius* furnishes a constitution of Frederick *Ænobarbus*, who came to the empire in 1152, about the immunity of heralds, which has been considered less exceptionable than the statute of Henry I. Accordingly the establishment of heralds has been referred by a learned and noble author to an event that occurred about that period, who conjectured they owed their origin to the crusades, or religious expeditions to the holy land. This opinion appears to have been adopted by most modern writers. It is conjectured, that could the point at which we are essaying, be once ascertained, to achieve the duties assigned them, and the purposes for which they were first appointed in European courts, a firm step would be made towards ascertaining their comparatively modern origin in European

kingdoms. It has been alleged, that the Emperors were accustomed to take under their protection such of their valiant soldiers of gentilitial birth, who had been grievously wounded, or maimed in their wars, which soldiers were distinguished by the name of "veterans;" to whose judgment and counsel the Emperors were wont to pay great respect: whence the attendance of such, as a council of war, became necessary to be always near the persons of the Emperors. They were accordingly employed in negotiating matters and litigated questions, between their masters and their rebellious subjects or their foreign enemies.

The institution of jousts, tilts, and tournaments, which also originated in Germany, as has been said, opened a new sphere of employment for those veterans, as none were suffered to give, or would any receive a challenge to enter the lists, without the gentility of the party was proved, which was done by his armorial bearing. The establishment of the feudal system, which took place about this period in Europe, we conceive originated in Egypt on the following occasion. *Diodorus Siculus* relates, in the fourth chapter of his first book, that the father of Sesostris, caused all the youths in Egypt, who were born upon the same day with his son, to be bred up and educated with that prince: that their diet, education, and exercise, being the same, without the least distinction; their labours being hard and difficult, and being compelled to run 180 furlongs before breakfast, by these means, when they came to man's estate, they were fit to become either commanders, or to undertake any brave or noble enterprise, or gallant action, from the vigour of their bodies and the excellent endowment of their minds. This young prince is reported to have conquered Arabia in his youth by the assistance of these his brave comrades. Upon his return, after he had come to the crown, he bestowed upon those his companions, amounting to the number of above 1700, large estates in lands in the richest parts of Egypt, that they might not in the least want any thing, reserving only their attendance upon him in his wars.

The original service, called knights' service, in Europe, having, in consequence of the establishment of this system become general, those tenants of this description, in order to their being more readily known, assumed some device or token, which they bore upon their shields, targets, and banners, which devices were afterwards called *arms*. No one, without his having a certificate of such his gentility from the heralds or veterans, was considered as a gentleman, of which his device, symbol, or arms were the criterion.

Upon the introduction of the crusades in the eleventh century, those veterans would be selected as the most proper persons for carrying on a correspondence between the confederate princes; and as each prince had then his peculiar symbol and armorial ensign, what could be more obvious than the investiture of such correspondents with their masters' coat of arms, which they wore painted upon their surtout, surcoat, or upper garment. This, we conceive, will demonstrate not only the original of the term "*coat of arms*," but also furnish a probable surmise of the official distinction of the heralds themselves into "*kings of arms*," &c. Likewise the name "*herald*" would accrue and become prevalent from their frequent intercourse among the hosts of various princes.

It is remarked, that soon after this period, the term *heraldus* frequently occurs in the constitutions of Frederick Ænobarbus, providing for the safe conduct, or assigning passports for the inviolable security of these officers. With equal probability it may be also urged, that the benefit which the princes then in alliance, derived from such officers, was so evident, that after their return into their own countries, they still retained this their manner of intercourse; which, at length, was extended to all messages to be sent, and all negotiations to be carried on and concluded between friends and enemies. It should seem, the exact period of the introduction of the office of herald into England, has not yet been fully agreed to; although for the subsequent reasons, it may be probably fixed as early as the commencement of the reign of Henry I. notwithstanding the oldest record which names them occurs in the 12th of Edward III. they are found mentioned in a pell roll, and a wardrobe account of that year. Sir Henry Spelman proves from facts which he furnishes, that they must have existed long before that time. He says, "*England had its heralds*," at the period we have first assigned for that purpose, in the time of Edward I. "and that they were then actually divided into classes." It has, it appears, been suggested by some, that the Saxon kings had such officers. But upon the Norman invasion, they are said to be unknown. Robert, the subjugator's eldest son, undertook an expedition into the holy land, where, it may be presumed, he became acquainted with the institution; but the influence of that prince *here* was very circumscribed.

However, even after his return, he does not appear to have established such officers in Normandy. Richard Cœur de Lion was the first English monarch who personally en-

gaged in the crusades; he certainly must also have become acquainted with the office and its utility; as the office had then been long established in Germany and France, from one of which countries, it is most probable, it was first introduced into England: hence it has been inferred that he did not primarily introduce them into England. Henry Fitzempress must have been well acquainted with their establishment and importance in the empire when he ascended the English throne; his subsequent intercourse with the courts of France and Germany must have occasioned heralds to have frequently passed between those courts and that of England.

From other collateral circumstances, it is believed, that they were first introduced here in the beginning of the reign of the first Edward. It is also, on all hands stated, that it is probable the English heralds were first chosen from the veterans, like those of Germany, as being the best qualified to execute that office, their functions being the same. Edmondson says, the primary duty of English heralds, at the time of their establishment, quadrated exactly with that of the heralds of foreign princes, in carrying and delivering all messages of importance to allies, enemies, and rebels; in giving solemn defiance, and denunciations of war; in summoning cities, castles, &c. to surrender; in making propositions of peace, truce, and accommodation; and offering mercy and pardon to rebellious subjects and insurgents. At the time of signing leagues, truces, and treaties of peace, they attended, and sometimes were joined in it; honours which they occasionally enjoyed, until the reign of Henry VII. By this admission of heralds to a share in public negotiations, they acquired importance; they had easy access to the sovereign; became respectable and confidential; and they were placed in such a state, as secured to them ample allowances in fees, rewards, &c.; besides several especial privileges and immunities, among which was an exemption from all taxes, aids, and assessments, &c. From the time of their introduction into this kingdom, they were subordinate ministers to the Constable and Earl Marshal of England, and as such executed the orders, and assisted in the management and conduct of several branches of duty within the departments of these two great officers. Hence they regulated armorial bearings, and also the order of ceremonials on marriages, christenings, burials, or other great and public occasions. Our kings anciently created heralds with their own hands; they also christened them, by pouring wine upon their heads from a golden cup, or chalice; invested

them with the royal military habit, or surcoat of the sovereign arms, agreeably to the practice of other princes, and commanded them to wear such surcoats, &c. as ensigns of their office, when they were in execution of any branch of their duty. With the before-mentioned immunities, they also enjoyed a safe conduct on belligerent ground, until they arrived in the dominions of the King their master. At the time of their creation by the earl-marshal, they take the oath of an herald upon the sword, are invested with a tabard of the royal arms, embroidered on satin, not so rich as that of the king's, but better than the pursuivants, and a silver collar of SS. Also among the nobility, we find heralds in their funeral rites, celebration of marriages, christenings, and other public festivities, exercising the same forms and sustaining the same grandeur as those of the royal family. The management of public shows, triumphs, &c. was committed by the sovereign to the care and conduct of heralds; being thus qualified, they were usually engaged to form, regulate, and superintend such festivities, &c. as the nobility determined to have performed on any family occasion, which they apprehended would redound to their honour or aggrandizement. On family arms becoming the distinguishing criterion between a gentleman and a peasant, it was necessary, in any feat of arms, that persons should prove, to the satisfaction of the heralds, that they were gentlemen of coat armour.

Gentlemen took care to have their arms embroidered upon their common wearing surcoats, and would not suffer inferior persons, although masters of acquired wealth, to use tokens of gentilitial distinction. So jealous were they of any infringement of the armorial rights to which they were entitled, that whenever the arms which themselves or families had borne, happened to be claimed by any other gentleman, they vindicated their rights by duel. Hence, therefore, the necessity for the heralds to draw out with accuracy the authentic genealogies of noble and gentilitial families; to continue, from time to time, and preserve their pedigrees in direct and collateral lines; and to have a perfect knowledge of all hereditary arms, ensigns, armorial badges of honour, and other external marks; as well of personal honours as of family rank and distinction.

These heraldic regulations have been subservient to several very important purposes, besides those for which they were originally intended. Genealogical tables and authentic pedigrees regularly deduced, contain memorials of past transactions and events, and from them historians and chro-

nologers have derived considerable assistance; they have likewise tended to the detection of forgeries, frauds, and other impostures; established titles by marriage, as well as consanguinity; defended legitimacy of blood; ascertained family alliances; proved and maintained affinity, and vindicated and corroborated titles of lands to the possessors; furnished effectual evidence for settling claims and rights of inheritance.

Originally, *i. e.* in the year 1483, in the reign of Richard III. letters patent passed for incorporating the heralds into a *College of Arms*, upon its present foundation; with directions to the officers thereof, and vesting them with full powers to summon all such as claimed or assumed arms, to appear in the court of the Earl Marshal, and establish their claim: which establishment, then created, had powers deputed to them to grant arms to new families. This privilege multiplied the figures used in heraldic bearings, of course few before the creation thereof, and chiefly natural. But, upon this occasion, the entire natural world was ransacked, and the regions of fancy and poetry almost entirely explored to furnish varieties, for all who then obtained this ancient and honourable distinction.

None but the nobility had at first the privilege of bearing arms. Charles V. of France, by charter of 1371, permitted the citizens of Paris that privilege, from whence the example was aspired to by other cities, anciently eminent in most European countries, and conceded to them by their several respective sovereigns.

After the practice of including the arms of every female heir, intermarrying with a family, the art of the herald became highly essential to ascertain the distinctions necessary to be observed upon these occasions; requiring much professional ability and very consummate skill.

Henry V. appears to have entertained a proper opinion of the necessity of ascertaining those appointed to this privilege, from his edict in the seventh year of his reign.

Heraldic visitations were originally appointed to inquire into family arms. A recent learned lawyer, Mr. Justice Blackstone, appears to regret that such institutions are not now occasionally attended to; for the failure of inquisitions, *post mortem*, by the abolition of military tenures, combined with the negligence of heralds in omitting their usual progresses, has rendered the proofs of modern descent, for the recovery of estates, or succession to titles of honour, more difficult than they anciently were. This will be, indeed, remedied for the future, with respect to claims of peerage, by a late

standing order of the House of Lords (11th May, 1767), directing the heralds to take exact accounts and preserve regular entries of all peers and peeresses of England and their respective descendants, and an exact pedigree of each peer and his family, on the day of his first admission, to be delivered to the house by the Garter principal king at arms. But the general inconvenience affecting private successions remains still without remedy.

Modern heralds, that is, those we properly call heralds, have lost much of the official distinction enjoyed by the ancient ones. What relates to making out arms, rectifying abuses therein, &c. is now chiefly committed to the kings at arms: and in the army a drum or trumpet has succeeded to the official functions of heralds; being sent by the generals on the same errands, and on that account enjoying the same privileges. Their persons are under the protection of the law of nations, when they bear the marks of their office publicly; *i. e.* the drummer his drum, and the trumpeter his trumpet, in the same manner as was the coat of the herald.

The classes which distinguish these officers are kings, (of which the chief is called Garter principal king at arms,) heralds, and pursuivants. Though the whole three orders are styled heralds, yet it is said that only the two first are so, the last being regarded as novices or probationers. It is remarked that the term herald is very properly applied to the king at arms; because, it is said, the order of herald is comprehended under that of a provincial king; the office of such a king having in it the office of a herald *ex vi oreلمis*, and something more; for to be a herald was but a step to the kingship, as the being a pursuivant or novice to the office of herald. These orders and degrees bear the impress of a distinct character; that is, the person who is created king at arms is qualified with a new capacity to perform certain functions, which before his new promotion, whilst he was only a herald, he had no pretence to do; but the pursuivants being only candidates, probationers, or novitiates, and not really officers, were therefore very improperly included in the term herald. It hath been said, that persons could not arrive at the dignity of herald without having been seven years pursuivant, and that they could not quit the function of herald but to be made king at arms.

Heralds being, at first, military men, had on that account the additions of “*armorum*,” “*ad arma*,” and “*d’arma*,” and not upon any relation to coat-armour or ensigns of honour. Indeed, coat-arms themselves belonged to no other

than military men, as Mr. Selden, in his “*Titles of Honour*,” hath fully proved. Sir Henry Spelman is of opinion, that the title of king at arms was attributed to such officers in England as belonged immediately to the king’s majesty, whilst those attached to princes of the blood-royal or to the nobility were simply styled heralds.

Of the six heralds of England who have had a long succession, and continue to receive salaries from the public, *Windsor* has its denomination from the royal castle or palace; *Chester*, *Lancaster*, *Richmond*, *Somerset*, and *York*, from counties or shires which have at sundry times, as Sir Henry Spelman observes, been the honours or appendages of the younger sons of the crown. And, indeed, we find the heralds with most of these titles belonging to the Sovereign, and sometimes to the nobility who had those honours. It should be observed, however, that though their titles are taken from territories or earldoms, yet these officers are not local or confined to any particular district, their jurisdiction not being circumscribed to those places, for no one herald is either confined within any province, or excluded from officiating within the precincts of those counties whose titles are borne by others. The titles being merely nominal, the offices are offices at large.

After the six titles already mentioned, in which a succession hath continued to this time, there were at various periods others, and probably heralds of the nobility; as *Arundel*, *Bedford*, *Buckingham*, *Carlisle*, *Cornwall*, *Clarence*, *Derby*, *Dorset*, *Exeter*, *Gloucester*, *Huntingdon*, *Hereford*, *Hertford*, *Leicester*, *Nottingham*, *Norfolk*, *Northumberland*, *Pembroke*, *Salisbury*, *Suffolk*, *Wales*, *Warwick*, and *Worcester*. Some heralds derived their titles from provinces or territories in distant kingdoms where our sovereigns have had possessions: as *Bourdeaux*, *Brunswick*, *Guienne*, *Guisnes*, *Hanover*, *Maine*. The arms, quarterings, and badges of the crown have also given to heralds denominations; as *Faucon*, *Fleur de lis*, *Leopard*, *Rose*, and *Blanche Coursier*. Places of signal victories have communicated the like; as *Agincourt* and *Nazar*. Others have been obtained from various other circumstances.

It is observed that this distinction of heralds occurred in the 19th of Hen. VIII. for the first time: it appears from Edmondson, that such creations took place when there was a plenarty in all the titles of those in ordinary, and had been adopted sometimes with a design that these new officers should in preference to the senior pursuivant succeed to the first vacancy that might happen in any of the titles in

ordinary, and have a patent with a salary from the crown; sometimes, in order that the person favoured might immediately after his creation be promoted to the first vacant kingship, as it were *per salutem*; it being, as Anthony Wood remarks in *Ath. Oxon.* an established rule that no man can be made a king at arms before he is a herald; and at other times to enlarge the number of heralds, for the better and easier performance of their duty. The three heralds extraordinary are *Arundel*, *Norfolk*, and *Mowbray*.

The office of heralds, ordinary and extraordinary, is to wait at court, to order and attend public solemnities, at coronations, installations, funerals, and to proclaim war and peace; to attend to the regulation of armorial bearings, search pedigrees, &c. under the authority of the Earl Marshal and his deputy. The six heralds, with the three kings at arms, and the four pursuivants, are a college; and form the institution founded by Richard III. previously mentioned. Clarencieux and Norroy kings at arms are also *provincial* heralds.

HORSE-SHOES.

When we consider the vast importance of security to the feet of that useful animal the horse, we cannot but wonder that considering the very rough roads which the ancients must occasionally have had to travel, that some metallic shoes had not been invented and introduced previously to the period when they appeared.

That upon the safety of the animal the security of the rider necessarily depended, cannot be questioned. Hence, then, we do not wonder to observe, that the sagacious Aristotle¹ and Pliny² should observe upon the covering placed upon the feet of those animals of draught and burden. From what those authors have said, however, we dare not conclude that the feet of horses or camels were faced or shod with iron; but it should rather seem that in time of war, or on long journeys, the feet of both kinds of beasts were prepared with such species of shoes as the common people wore, and which were generally made of strong ox leather (*curiscalla*.) We are told that when the hoofs of cattle, particularly oxen, had sustained any injury or hurt, they were furnished with shoes made of *spartum* or *spartium*

¹ Hist. Anim. ed. Scaligeri, ii. 6. p. 165.

² Hist. Nat. lib. xi. c. 43.

junceum, or Spanish or African broom, with which linen is often manufactured in the south of France and Italy; also shoes of some of the plants of the *hemp* kind, which were woven or plaited together. Although these may be considered as only a species of surgical bandages with regard to oxen; but such shoes were particularly given to mules, which in ancient days were employed much more than at present for riding; and from certain instances of immoderate extravagance in people of rank, it appears that they had for their animals very costly shoes of some of the noblest metals. Nero, when he undertook short journeys, was drawn always by mules shod with silver,³ and those of his wife, *Poppæa*, were shod with gold.⁴

The circumstance being barely mentioned without any definite detail, we are anxious to afford any certain information on the mode in which those shoes were constructed. From a passage in *Dio Cassius*, there appears to be some reason to conceive that it was the upper part only that was made of those noble metals, or that they were plaited from thin slips.⁵

Xenophon also relates in *De Cyri Min. Expedit.* p. 228, that a certain people in Asia were in the habit of drawing socks over the feet of their horses when the snow lay deep on the ground; or, he adds, they would have sunk up to their bellies in the snow, which must have been when it was frozen to prevent their slipping; for we are unacquainted with any thing but *snow-shoes* which could have sustained them upon the surface. The Kamtschatkian employs the same means to preserve the feet of his dogs which draw his sledge or catch his seals upon the ice. Those species of shoes, it appears from Captain Cook's last voyage, are so ingeniously made as to be bound, and at the same time to admit the claws of the animal through them.

Arrian, in *Commentar. in Epictetum*, enumerates shoes among the necessary riding-furniture for an ass.

From a passage found in Suetonius, we may infer that the Roman horse-shoes were put on in the manner we have mentioned; for that author says, that the coachman of Vespasian once stopped to put on the shoes of his mules: this being the case, the probability appears pretty certain, that in deep roads and moist soils the animals must have frequently lost their shoes.

³ Sueton. Vita Neronis, c. 30.

⁴ Plin. lib. xxxiii. c. 11.

⁵ Dio Cassius, or Xiphilinus, lxii. 28.

Artemidorus speaks of a shod horse, and uses the same kind of expression whilst speaking of other cattle. Winkelman has described a cut stone in the collection of Baron Stosch, on which is represented the figure of a man holding up one foot of a horse, whilst another, kneeling, is employed in fastening a shoe.⁶

That it was not usual to shoe the war horse, may be gathered from this, when Mithridates was besieging *Cyzicus*, he was obliged to send his cavalry to Bithynia, because the hoofs of the horses were entirely spoiled and worn out. Diodorus Siculus informs us, in Alexander's expedition, that he proceeded with uninterrupted marches until the feet of his horses were entirely broken and destroyed. A like instance occurs in *Cinnamus*, where the cavalry were obliged to be left behind, because they had suffered considerably in their hoofs, to which he adds, they were often liable. Hence it may, perhaps, appear, that such horse-shoes as we now have were unknown to the ancients; and Chardin gives no representation of them in ancient Persian antiquities. Niebuhr, in the second volume of his *Travels*, expressly says, the ancient Persians had no proper saddles or stirrups. In the grave of *Childeric*, a northern chieftain and King of France, was discovered a piece of iron, which the learned antiquarians who saw it pronounced, from that portion of it which the rust had left, to have been an old *horse-shoe*; they saw, or thought they saw, four distinct apertures for nails on each side; but whilst they were endeavouring to remove the corrosive excrescence of rust, to ascertain this with more certainty, it broke under their hands.⁷ In the same grave where this was discovered, was also found a gold ring, with the royal image, and an inscription of the name of the monarch.⁸ The reason why

⁶ Description des Pierres gravées du Baron de Stosch. A Florence, 1760, 4to. p. 169.

⁷ P. J. Von Strahlenberg enumerates those things discovered in the ancient Tartarian sepulchres; but among them, although he speaks of stirrups, and bits for bridles, he says nothing of horse-shoes. Vide 365, *ubi supra*.

⁸ The description of this curious discovery made as above, appears in *Anastasis Childerici, Francorum Regis, sive Thesaurus sepulchralis Tornaci Nerviorum effossus*; auctore J. J. Chifletio. Antverpiæ, 1655. 4to. p. 224. The whole description is as follows: "Ferrea solea; sed ita rubigine absumpta, ut dum veruculo clavorum foramina (quæ utrimque quaterna erant) purgare leviter tentarem, ferrum putre in fragmenta dissiluerit, et ex parte dumtaxat hic representari potuerit." Montfaucon, in *Les Monumens de la Monarchie Française*, Paris, 1729, 4 vol. fol. i. p. 16. tab. 6, has given also an engraving of it, and says below: "Solea ferrea equi regii hic tota representatur, etsi pars ejus tantum reperta sit; sed ex illa parte totius formam excipere haud difficile fuit. Modicæ magnitudinis equus erat."

this appears here is, that if the relique discovered was really an horse-shoe, it must have been one of the most ancient specimens known; because, we find that monarch died anno 481; his grave was discovered at Tournay, in 1653. The occasion of his having an horse-shoe in it was, from the creed of his religion; the superstitious belief of the *Scandinavians*, taught them to place implicit confidence in the power of this amulet to prevent the ingress of evil spirits. See *Mallet's Introduction to Northern Mythology*. The remains of this belief is even now often seen in the obscure streets of this metropolis, where the mystic shoe appears as the faithful guardian of the domestic threshold.

There have been, we know, some Greek scholars who have in part proved that the usual word they have read hitherto for shoes, is not a designation of the shoes in question. They, accordingly, contend that the Greek word *σελιναια*, was meant to denote those shoes; in the company of those superior authorities to whom we allude, we bow, and as mere unqualified students, in that tongue, we do not presume to give an opinion, but should be inclined to yield our ideas to their very superior direction. The Greek writings of *Pancirollus*, and the translation of *Nicetas*, first gave occasion, as we understand, for this investigation, and the above is the result. This, however, does not appear to alter the previously delivered opinion respecting the use of iron shoes among the Greeks. But we learn from Xenophon's *De re Equestri*, p. 559, that that author's words have been misunderstood, he having therein furnished directions for the proper choice of horses, by attending to a precaution very eminent among the Greeks, to have such of peculiar sound and hard foot, and which by stamping would be as musical as a lyre. Xenophon directs, also, as to the nature of the place for trial of this experiment, observing, it should be done on flat stones, which stones he recommends to be *fastened down with iron*; but intimates nothing about *iron horse-shoes*, as some have imagined.

It is, we understand, the opinion of the French historian, *Daniel*, that, in the ninth century horses were *not* shod always, but only in the time of frost, and on some other very particular occasions.

The practice of shoeing was also introduced into England by William I. We are told that this monarch gave the city of Northampton as a fief to a certain person, one of his attendants, in consideration of his paying a stated sum, yearly, for the shoeing of horses. And it is also alleged that

Henry, or *Hugh de Ferres*, or *de Ferrers*, was the person who held this fief on the above condition, and who was the patriarchal ancestor of the family of that name, and which family still bear six horse-shoes in their coat armour; he was the person whom that prince entrusted to inspect his *farriers*.⁹

We should not omit to observe, that it is remarked that *horse-shoes* have been found, with other riding furniture, in the graves of the old inhabitants of some parts of ancient Germany, and also in those of the Vandals in the north of Europe: this also should be noticed, that the peculiar application of the opinion we have presumed to give with respect to the occasion for inhuming one with the corpse of Childeric, will be very obvious.

HOSPITALS FOR INVALIDS, INFIRMARIES, AND FIELD LAZARETTES.

To describe circumstantially, correctly, and historically, every institution with which the world has been blessed, having these benevolent objects in view, must, we think, require no ordinary information in the individual who could effect it with perspicuity and correct propriety. Even for a writer to confine himself to those popular and national institutions whose name declare their use, this must require much information, without attempting to explore causes through effects, which must lie beyond the power of mere human wisdom. Should it be confessed difficult to develope the hidden secrets of the heart, how much more so will it be to trace the wonders resulting from the Providence of the Almighty will, who alone can direct good to come from evil. We are assured that man was not brought upon the theatre of the world for himself alone, but to assist and be reciprocally assisted by his fellows. Many great and good men have felt this truth, and have obeyed the most generous of human feelings, liberally giving where heaven has bestowed the means and lent the heart. We also know, that it is a failing in some natures to believe that every thing which is noble, just, great, or good, must originate either among those with whom they are intimately acquainted, or that it cannot be produced by any beyond the pale of their own nation or their own faith. Such are to be informed by us

⁹ Brook's Discovery of Errors in the Catalogue of the Nobility, p. 198.

of the contrary; the motto of nature is *semper eadem*; true to herself and always consistent, she is the same in every country and in every age.

How much soever we lament our own insufficiency to effect these great purposes, the performance of them has become a duty, and we propose to deliver, to the best of our ability, all our own information, with what we can collect from others, in the most simple and perspicuous manner possible, and to the best of our judgment and belief.

We well remember to have read in the history of Arabia, of such great, such liberal instances of benevolence among that people, (Mahometans,) as would shake the belief of the most partial to self or country,—would shame their paltry insignificancy. To check the over weanings of partiality, to soften prejudice, to declare the truth, and to vindicate the Providence of Heaven, are favourite employments with us: with an intention to promote these views, we shall briefly detail an incident from the Arabian history, which will serve to evince that humanity and benevolence are of no specific country or people, confined to no particular climate, faith, or soil; but that they are universal as the sweet breath of heaven, and exist among all people, unshackled by any particular formula of religious belief.¹

¹ The solitary peninsula, Arabia, is encompassed by the most civilized nations of the ancient world; the merchant is the friend to mankind; and the annual caravans imported the first seeds of knowledge and politeness into the cities, and even the camps of the desert. The Arabs have always blended a very considerable degree of beneficence, hospitality, and politeness with their ferocity. The same hospitality which was practised by Abraham, and celebrated by Homer, is still renewed in the camps of the Arabs; and examples of this kind among them exceed any thing that can be produced from other nations. The contrary vice was held among them in such contempt, that one of their poets upbraids the inhabitants of a certain district, in terms of bitter reproach, alleging that none of their men had hearts to give, nor their women to deny. After the time of Mahomet, they were no less liberal than their ancestors had been. Sale (Pref. Koran, p, 21.) mentions the following singular instance: “Three men were disputing in the court of the Caaba, who was the most liberal person among the Arabs. One gave the preference to *Abdallah*, another to *Kais*, and a third to *Arabah*. It was proposed, however, for the decision of the dispute, that each should go to his friend and ask his assistance. *Abdallah*’s friend found him with his foot in the stirrup, mounting his camel, and just setting out on a journey, and thus accosted him, ‘Son of the uncle of the apostle of God, I am a traveller, and in distress.’ Upon which *Abdallah* instantly dismounted, and presented the pilgrim with his camel, its rich caparison, some vests of silk, and a purse of 4000 pieces of gold. The servant of *Kais* informed the second suppliant, that his master was asleep, but that he had rather relieve his necessity than awaken his master; accordingly, he gave him a purse of 7000 pieces of gold; assuring him it was all the money they then had in the house; and he directed him to go to those who had the charge of the camels, with an order for a camel and a slave. When

Notwithstanding the general terms in which we have above expressed ourselves, we are not ignorant that there are innumerable exceptions to be discovered to those general rules, which are found constantly to pervade humanity, among people of all nations, tenets, and persuasions. The motives which influence a want of benevolence in our species, are almost as various as they are innumerable.

But we now leave general principles for the recitation of facts, after one more observation. Being among the foremost to admit every benefit to the divine nature of the religion we profess, which can be claimed by the Christian system; we, nevertheless, contend, that the principle of benevolence, or the participation of fellow suffering, is to be discovered in human and rational creatures previous to the tenets of Christianity being implanted in our nature. Alas! were not nature, in her dispensations, thus general, in how deplorable a state must nine tenths of the population of the earth be situated? When the immensely extensive districts are considered, where population is as numerous as insects in the sun, and also where the superior light of lucid Christianity has never appeared, or if it has faintly irradiated some, no general illumination remains visible: those universal principles will be seen, presently, to be of utility. It has been generally remarked by some, and it is believed by more, that there was never any moral excellence observed in the world previous to the appearance of the *Gospel of Christ*. That this blessed book most effectually reminds us of those duties we owe to our Creator, and our fellow creatures; that its precepts were proved and its validity established by the most potent and perfect of all evidence, being sealed with the blood of its great promulgators, and sanctioned by other unquestionable evidences of its truth;—none can be more thoroughly conscious than ourselves. Also, that the impressions it has

Kais awoke, and was informed of what his servant had done, he gave him his freedom, and asked him why he did not call him, 'For,' says he, 'I would have given him more.' The third person went to Arabah, who being dim-sighted, was leaning on two slaves, and just coming out of his house in order to attend the house of prayer. As soon as his case was made known, Arabah clapped his hands together, lamented his misfortune, as he had no money, but desired him to take his two slaves. When they were refused, Arabah protested that if they were not taken, they should be enfranchised; and leaving the slaves groped along by the wall. Arabah was pronounced the most hospitable of the three."

The character of Hatem is the most perfect model of Arabian virtue. He is represented by *D'Herbelot*, (*Bibl. Orient.* p. 406.) as brave and liberal, an eloquent poet, and a successful robber. Forty camels were roasted at his hospitable feasts; and at the prayer of a suppliant enemy, he restored both the captives and the spoil.

made upon the heart, in these respects, have been more general than they were, at least in Europe, anterior to its appearance, we are also ready to concede. Believing this anticipation will be established by what is to follow, we, accordingly, find no establishments of the nature of those which head this article, in Europe, or that portion of Asia with which we are acquainted, anterior to the establishment of the Christian system; unless, indeed, those hospitals sacred to *Esculapius*, among the Greeks and Romans are to be so considered; but we submit they will not bear this construction to be put upon them.

Under our previous general head we have considered the first hospitable receptacles for pilgrims, travellers, and strangers, subject to the Christian system; but with this idea, we conceive the feelings of superior antiquity should be consulted. We have, in many places in the previous pages, discovered traits of this benevolent spirit, which we now presume to notice was also generally encouraged by the doctrine of Pagan mythology, as one of the most ancient of the Grecian poets informs us:

“ ——— The gods, also, like strangers come from far,
 “ In various shapes, within your towns appear;
 “ Viewing men’s good and evil acts.”

HESIOD.

Nay, we may discover how much hospitality was appreciated, by the punishment which it is recorded certain Bœotians experienced who refused to entertain Jupiter and Mercury, when upon their travels.

The first regular establishment for benevolent purposes of which we can find a record, occurs not till since the establishment of the Christian religion; and we believe it first appears in those hospitable mansions, erected for the reception of pilgrims and travellers.

Notwithstanding how much reproach Christianity and its friends in the earliest ages have suffered, from the untrue and impotent malice of its enemies, in every direction, as well avowed as concealed; and although it is admitted that the Christian system certainly may have in a degree, at various periods, increased mendicity, one ground of Pagan reproach, yet its principles encourage forbearance to demand our own, or to preserve it; to do to others as we would expect a like return from them; and as the fundamental basis to every other virtue, it enforceth charity. It is presumed at first to have been distressing to the Emperor Julian, to confess this superiority; and in order to render his own religion equally specious, he commanded

its priests to erect for the unfortunate, inns, called *Xenodochia*, into which they could be received; and he assigned to them funds answerable to that purpose. Into those were admitted not only persons of his own persuasion, but of every other, Christians as well as Pagans. How much the Emperor interested himself to weaken this mean, by which Christians, then in the Pagan world called *Galilæans*, procured respect, love, and attachment, may be seen by an oration, wherein he attempted to inculcate the Christian principles as his own.² This imitation of the Christian religion contributed, it has been conceived, more to recommend it, than bring it into discredit; although it has been ridiculed by Gregory Nazianzenus, in his third oration.

The care of providing necessary sustenance and support for those travellers who met with sickness or accidents upon their journeys, previous to the establishment of general accommodations for that purpose, should certainly be seen as belonging to the police establishment of kingdoms; in all forms of government the rulers should have considered this as a portion of public establishments in providing for the internal regulation of their dominions; but that love of power, which in the earlier as well as in latter periods they cherished, and to preserve it after it was obtained, was found to occupy too much of their attention, in those turbulent times, to attend to those necessary regulations.

Thus, the neglect on the part of the sovereign, should have been regulated by the clergy, as we discover to have been the case; when *Medea* came to *Corinth* in search of *Jason*, she sought entertainment in the temple of Juno, the hospitable deity, in which the Priestess *Theano* officiated: upon which account, we find, since Christianity has been established, among the decrees of various councils, a great number of regulations which illustrate this portion of the political history of states.

The establishment of the first houses for the sick, appears among the services which the clergy have rendered to humanity. The first of these we find upon record, was that built in Rome by the Roman lady *Fabiola*, a particular friend of St. Jerome, in the fifth century; the mention of it is found in *Hieron. ep. 39. i. e.* “*Primo omnium nosocomium, id est languentium villam instituit,*

² This imperial decree is preserved by *Sozomenus*, in his *Ecclesiastical History*, v. 16. edit. Valesii, Amstelod. 1695, fol. p. 619, where is abundant information. Vide *Juliani Opera*, edit. Spanhemii, Lipsiæ, 1696, fol. p. 430, and *Julian's Oration*, p. 305.

“ in quo ægrotantes colligeret de plateis, et consumpta languoribus atque inedia miserorum membra foveret.”

The frequency of pilgrimages to holy places, denominated by mistaken zeal as a part of duty, and often to very distant countries, came to be considered as an essential part of religion; as this increased, the number of receptacles for pilgrims kept a proportionate ratio, of course. The majority of people travelling upon these expeditions went without money, expecting to find gratuitous assistance. The clergy found it their interest to increase the number of pilgrimages; hence the absolute necessity of their providing for these devotees must appear. However, to suppose that a change in habit, nutriment, and other causes, with the fatigue of travelling, should not produce occasional sickness among those pilgrims, would be to conjecture what could not have been, in the nature of things, the case.

But as the longest and most dangerous pilgrimages were to the place of nativity, and to the holy sepulchre; these lying beyond the European boundaries, where no countrymen, nor even Christians inhabited, those poor travellers must of necessity have perished, had not the priests taken care to provide those receptacles on the road thither. Accordingly Jerome built an hospital at Bethlehem, and his friend Paula caused several to be erected on the road to that place, in order, as she says, that those devout idlers might fare better than the mother of God, who on her journey could find no inn. In a similar manner, we are told, the Scotch and Irish erected hospitals in France, for their countrymen, on their journey to Rome, in passing through that kingdom.

But hospitals were discovered to have been most necessary in barren and wild countries, in extensive forests, and on the banks of large rivers, where were no bridges, and where it is probable they collected in such numbers that it first gave occasion to the origin of villages upon them, still discovered in similar situations.

Charlemagne was advised by Pope *Adrian I.* to notice on the hospitals built on the Alps; and in 855, *Louis II.* caused those situated on the mountains of France to be visited and repaired, the ruins of many of which still exist.

Towards the close of the eleventh century, brotherhoods were formed, whose societies undertook to provide for sick pilgrims on their way to and from the holy land. Numerous opulent persons, when dying, were prevailed on, either from motives of personal feeling, or from the cajolement of the religious about them, of that eventful period, to bequeath

their property to those religious establishments, in which it may be probable they had themselves found consolation and relief; or many who were cured, in the grateful performance of their vows, gave large portions of their property to those societies. So that in Palestine the officers of religion were enabled to erect houses upon a liberal scale, and with costly accommodations; much more so than were to be seen in Europe. Their efforts, therefore, in Palestine were considered by European princes and wealthy persons, who visited them, as the model of perfection; who being desirous to have similar foundations within their own kingdoms and domains, occasionally brought some of the brotherhood over with them; which in course of time were converted into orders of knighthood. Instances of these circumstances will be found in Möhsen's History of the Sciences, and his collection might be easily increased. In the same author may be seen an account of houses erected for the care of persons afflicted with cutaneous disorders, and of their conversion into PEST-HOUSES. Independent of the relief afforded for those, whom these establishments were intended to benefit, they also afforded a great relief to mercantile people, who, in the infancy, as it were, of modern commerce, generally travelled themselves with their goods for safety of their property.

However, *Muratori* asserts, and on good foundation, that the oldest hospitals were not meant for the sick or infirm, but rather for the healthy and sound: as far as the term hospital is now taken in its verbal sense, his assertion is unquestionably true. The oldest hospital on record, according to modern acceptation, was one founded by the famous LANFRANC, Archbishop of Canterbury, anno 1070, who caused one to be built at Canterbury, and fitted up in such a manner, as for one part of it to accommodate men, and the other women. This prelate, who was a native of Italy, might, perhaps, have conceived the idea from something he had seen in his own country.

After this establishment, numerous others in a variety of places were built, purposely for the accommodation of the sick and afflicted of humanity: these generally were erected in the vicinity of cathedrals, or collegiate abbeys and monasteries. The bishops and heads of these houses were the first visitors, who generally, from the subsequent occupation of their time, intrusted the office to deacons. In process of time, however, when similar establishments were founded by laymen, they were built separate and distant from ecclesiastical establishments. Here, however, the clergy still asserted

their prerogative to visit and interfere, looking upon it as a prerogative inseparable from their function, which conferred upon them an inherent right to such privilege. As sovereigns saw the power of the church daily increasing, they felt apprehensions for their own authority, which were not, at all times, ill founded; whence princes then claimed this privilege. There is also room to presume, they occasionally had cause to suspect the revenues of such establishments were not always administered as they ought to be; they therefore visited, to remedy this malpractice. Indeed, instances are not wanting where the letters patent of foundations stipulates for this authority to the sovereign alone, or occasionally to the successors of the founder.

Those institutions had, however, still the appearance of ecclesiastical establishments, and in many cases, retained their privileges; being exempted from all taxes and other public burdens.

In England, the enthusiasm of the people was so very great, that the government perceived the daily deterioration of family estates, from imprudent and irrational bequests; also, perhaps, for the motive in the crown arising from a jealousy of the clergy, that the legislative body saw it expedient to restrain the power of making bequests to ecclesiastical uses, by a statute called the *Statute of Mortmain*.

The internal economy of the oldest houses for reception of sick people is not known. Neither is it known whether physicians and surgeons were employed; but the contrary may be, we submit, presumed from what we have seen in a former article, (*Apothecaries*,) which leads us to suppose, that the religious, who had certainly leisure, and, perhaps, learning enough to read the ancient prescriptions, and sometimes, even a sufficiency of ingenuity to understand them, might officiate in a medical capacity.

In the hospital at Jerusalem, the knights and brothers attended the sick, bound up the wounds of those who had met with any misfortune, and in imitation of the *Homeric* heroes, acted as their physicians. Möhsen, who directs our authority, refers to the old romance of *Amadis de Gaul*, and to other books of knight-errantry, to observe how much these knights exerted themselves to obtain the best remedies. Amadis observes the *baume de commendeur* is one of the oldest compositions of this kind used in the days of knighthood.

Profound knowledge of medicine could not be expected among these military or clerical physicians, even were the account unintelligible of the skill of the first, as ren-

dered by *Guy de Chauliac*. This author wrote his book³ on the healing of wounds anno 1363, and mentions the different medical *sects*; among which he names the German knights as the fourth sect, who, he says, cured wounds by exorcism, beverages, oil, wool, and cabbage-leaves; and trusted to the belief that God had conferred a supernatural power on words, plants, and stones.

The oldest mention of physicians and surgeons established in houses for the sick, belonging to the order of Templars, found by Möhsen, was under the government of John de Lastic, who, in 1437, undertook the office of grand-master, and defined very exactly the duty of a physician and surgeon.⁴ It however, seems to those well informed, that regular bred and learned physicians attended such hospitals much earlier than that period. It is also noticed, that so long as this was not the case, there could be no opportunity afforded of instruction to young physicians or surgeons, for practice in their art, as our present hospitals afford at this time. It should also appear, that however backward was the *Æsculapian* art in Europe, it was not so in the east; but with respect to Persia, it is alleged some *Nestorian* priests had an hospital adjacent to their monastery, together with an institute or school for young physicians, who, under certain prescribed rules, were allowed to visit the sick. This establishment was in a town called *Gandisapora*, or, as Professor Sprengel has it, *Dschandisabor*, the medical school of which is not unfrequently mentioned after the seventh century. Those pupils who were desirous to attend the hospital for improvement, were first obliged to submit to a trial, and to read the Psalms of David and the New Testament: many who studied medicine here, attained also to the higher ecclesiastical dignities, which is now considered as the more surprising, as the other *Nestorian* schools in the East pay but little attention only to theology, and prohibit the young clergy entirely from the study of medicine.⁵

³ Of this title: *La grande Chirurgie de M. Guy de Chauliac, Medecin tres-fameux de l'Université de Montpellier—Restituée par M. Laurens Joubert. A Rouen, 1641, 8vo.*

⁴ 1. *Nova Statutorum ordinis S. Joannis Hierosolymitani editio. Madriti, 1577, small folio.* 2. *Privilegia ordinis S. Jo. Hierosol.* small folio. 3. *Statuta Hospitalis.* 4. *Histoire de Malthe, avec les Statuts et les Ordonnances de l'Ordre.* 5. *Codice del sacro militare ordine Gerosolimitano.* In Malta.

⁵ The proofs of this surprising relation to Europeans may be seen in *Assemani Bibliotheca Orientalis*, tom. iii. The first who collected and illustrated every thing belonging to this subject was J. H. Schulz, whose *Dissertation de Gandisapora Persarum quondam Academia*, was published in *Commentar. Acad. Scien. Petropolit.*

Mad-houses, for the reception of lunatics and the insane, seem to have been first established in the East. Zimmerman says, that so early as 491, there was a house of that kind at Jerusalem, the chief object of which was to take care of such monks as became insane in the monasteries, or such hermits who were visited by the same affliction in the deserts; he, however, asserts this without proof. The Jew, Benjamin of Tudela, was in Bagdad in the twelfth century, where he found many hospitals having nearly sixty shops or dispensaries belonging to them, which distributed, at the public expense, the necessary medicines. A large building, called *Dal Almeraphtan*, i. e. the House of Grace, was destined for the reception of insane people, where they were kept in chains till they were cured; the magistracy visiting the house every month, and examining the patients, those who were cured they returned to their friends.

To those establishments which form the subject of this article, belong also

HOSPITALS FOR INVALIDS, including all military establishments. Although true, that among many of the ancient nations the soldiers, as also sailors, as we often see among the Greeks, there appearing little or no distinction between the marine and land forces; but it often occurs that they speak of soldiers on ship-board, in the office for which moderns employ sailors only: but it may be true, that some who served by land, as well as those who fought on the ocean, frequently served voluntarily, and, we think, we remember having read that they did so, till the first Peloponnesian war; for to serve their country was regarded as one of the primary duties of a Grecian. Therefore those who served so, fought for no other reward than what they procured by plunder, and the spoils of the dead, and ransacking of cities; whence the so frequent recurrence of endeavours to procure the arms, &c. of those whom they had slain in battle, which, to a modern unacquainted with those customs, must, on reading the *Iliad* of Homer, be very disgusting, remarking that for those mercenary ends, they often let slip an opportunity to serve the common cause, whilst they were engaged in petty thefts from the dead. This example of the common men the chiefs also followed. Mark the conduct of the junto of *Ulysses* and *Diomed*, with respect to the horse of *Rhesus*, in the xth *Iliad*; and nume-

tom. xiii. ad an. 1741, p. 437. See also Sprengel's *Geschichte der Arzneykunst*, ii. p. 255. We collect the information from Professor Beckmann, iv. p. 478, *ut supra*.

rous other actions, apparently below the dignity of the martial character, which occur in that exquisite poem, the *Iliad*.

Under these circumstances, it must have been regarded as an indispensable obligation upon the public to make provision for the unfortunate and indigent, when become incapable of further service. The necessity to make such provision, is pointed out by natural equity, as well as political prudence. The last consideration appears when the governments have occasion for the services of others against an army, to defend themselves, or conquer other states: how could the men necessary to any enterprise be raised, unless they had some prospect of support after the bustle of war, when they had no more vigour remaining for bodily exertion?

Besides, also, the real assurance of a future provision for themselves, and a support for their families, must make them more courageous in the day of peril; so we shall find on inspecting the laws of the several Grecian states, such care was taken. And although it is admitted, that the present mode of fighting by artillery and small fire-arms, must require less personal courage and less address than the ancient mode of warfare, when "Greek met Greek," then came the glorious tug of war; although this may be as we have assumed, yet that does not in the least alter our previous position. For artillery and small arms can disable as well as destroy; therefore the obligation upon government is equally imperious, as it was in the most ancient days.

We find that *Solon* deducted something from the pay of soldiers, and employed it for the education of children, whose fathers had fallen in battle, in order that others might be encouraged to bravery. *Pisistratus*, also, followed his example, and made an order, that those who had lost any of their limbs in war, should be maintained at the public expense. The pensions allowed appear to have varied according to circumstances. A similar attention was also paid by the Romans to their invalids, *milites causarii*, or soldiers incapable of service, either from wounds or age. Many instances may be collected from the Justinian and Theodosian codes. Such were exempt not only from public burdens, but they frequently obtained lands and cattle, and money from the public revenues. They were also frequently assigned over to opulent families and societies to be taken care of. It is questionable whether the ancient Romans and the first Roman Emperors had the establishment of

hospitals for wounded soldiers, or those disabled by age or infirmity; notwithstanding Peter von Andlo, canon of Colmer, the German jurist, has asserted that the *taberna meritoria* was a house of that description.

Valerius Maximus says, that a traveller was murdered in that place, where he lodged; certainly, judging from hence, the most probable conjecture will be, that it was a public tavern or inn, which expressed passage coming in conjunction with an assertion of *Donatus*, that this place was a species of lodging, or perhaps an hotel purposely for the accommodation of the people of *Ravenna*, when they came to Rome to see any public spectacle.

Hardouin was also of opinion that there were in ancient Rome establishments of this description; to support his assertion, he quotes that of *Metellus*, the son-in-law of *Pompey*: the first he refers to, in support of this opinion, is founded upon a coin with the image of *Metellus*; on the reverse is the figure of a naked man walking, who holds in his right hand the palladium, and upon his left shoulder is a naked man; the inscription on the face of the medal is *Q. Metellus Pius*. And hence *Hardouin* infers, that he built a college for invalids, which he dedicated to *Pallas*, the protectress; on which account he surmises he obtained the surname of *Pius*. It really is very well for coins, or any other ambiguous hieroglyphic, to come in support of an historical fact; but it is very much liable to question, whether doubtful points can be supported from these alone. And the matter is still more questionable, when they oppose positively recorded verbal testimony.

For these reasons it is inferred, that in ancient Rome there was no such establishment so denominated, or any other establishment answering to that purpose, beyond those already mentioned.

The first establishment for invalids, with which we are at present acquainted, under the Romans, occurs under the reign of the Emperor *Alexius Comnenus*, at Constantinople. A complete description of it is found in the history of this prince, written by his fair daughter *Anna Comnena*, who says, the Emperor caused a great number of buildings, standing round a church, to be fitted up as an hospital, which undoubtedly never was exceeded in size; although other historians relate, that *Alexius* only revived and enlarged in an uncommon degree an old institution. It was, indeed, called the Orphan-house; but sick and indigent persons, of both sexes and every age, and, as the royal his-

torian expressly adds, soldiers dismissed from service, were admitted into it, and provided with bed, board, and clothing.⁶ Although the Emperor secured to it several sources of revenue, it does not appear to have existed long; for George Codinus, in the fifteenth century, says, the high office of director or master, had been disused.

The most ancient as well as the largest hospital for invalids known in Europe, is the *Hôtel des Invalides* at Paris, built anno 1670, a monument, it is said, of extravagance in the sovereign, rather than of care for the afflicted. The Kings of France enjoyed from the earliest times, a source of revenue or immunity, called *droit d'oblat*, which consisted in the power of quartering upon abbeys and monasteries, officers and soldiers unfit for service, and particularly the wounded. Traces of this practice are said to occur under the reign of Charles the Great, at least so it is reported by *Seissel*, in his life of Louis XII. who recites that there was an old tradition in Languedoc, that the abbot had been punished by that Prince, because he would not receive soldiers assigned to him. The different habits of the hosts and their guests, must really have been such as not to render them, it has been justly thought, altogether so social, as might be desired. Be this as it may, such really appears to have been the fact, and from the result will be, perhaps, more apparent; for the complaints on this subject appear to have been so serious under Henry IV. that he, at length, resolved to cause all invalids to be lodged and maintained together, in a place called *La Maison Royale de la Charité Chrétienne*. But the revenues destined for the support of this establishment were not sufficient; it was abolished under the same sovereign, and the invalids again became the inmates of the cloister. However, in course of time, these houses purchased exemption from this burden, by giving an annual pension to their guests; but the improvident soldiers soon spent the money, and then fell into a state of the greatest poverty. On this account Louis XIII. renewed the experiment of founding an hospital, but could not proceed for want of money. It was reserved for the mighty mind of Louis XIV. to project and complete this receptacle for the sons of military glory, when unfit for further service; accordingly, in 1670, he began to build the *Hôtel des Invalides*; the capacity of the design, and the projected elegance of execution, has been alleged against that very able monarch as a proof that he was more desirous

⁶ Annæ Comnenæ Alexiados, lib. xv. Venice edit. p. 383. Paris edit. p. 484.

to display his own magnificence and munificence, than to consult the comforts or convenience of his soldiers; but the actions of genius are often so viewed, the little failures of the eminent are always magnified by those who cannot conceive like them.

In the same year, 1670, the Royal Hospital for soldiers, at Chelsea, was founded in England by James II. and completed by William III. But a far larger and more magnificent establishment was first suggested by Queen Mary, the consort of William, for seamen, in the Royal Hospital at Greenwich, near London; determined on in the year 1694, and began in 1695, and from time to time in subsequent periods, enlarged and beautified.

We now consider the question respecting regular army surgeons; and here, as usual, go back into the womb of time as remote as possible, when we have records to direct us which have a general credence. The first cognizable record then, is the *Iliad* of Homer; in that we find the heroes before Troy having one physician, in *Machaon*. Homer is not critically nice in his distinction between the avocation of a physician and a practiser of the surgical art, but makes one perform both indiscriminately, as appears from a before-cited quotation from the 2d book of the *Iliad*. Here, like the knights in chivalry, the heroes dressed each others wounds, as we perceive in the case of *Patroclus* and *Eury-pilus*, *Iliad* xi.

At length the necessity of employing the progeny of Esculapius was seen by princes. The question of whether the Roman army was accompanied by surgeons, may to some appear participating of the features of the last on hospitals, to be rather uncertain. But on this we have the benefit of the *litera scriptura* of the learned *Saumaïse*, to decide a point of such importance; who expressly says, that "each cohort had in general a physician." Hence the reason why such terms as *medicus cohortis*, *medicus legionis*, appear in writers of transactions occurring in the period of the latter empire.

Indeed *Achilles Tattius*, who lived in the third century of our era, expressly, also, names a physician or surgeon accompanying an army, as *exercitus medicus*, in the original *ὁ τοῦ στρατοπέδου ἰατρός*: this, besides their being also known by the denominations just used, serves to convince us, and we do contend, that if there had not been such offices then existing, the names serving to denote the officers would not have appeared.

Besides these, there were also the *deputati*, described as

accompanying the army, and dispersed through the cavalry, who with two stirrups to one side of their saddle, were seen in the heat of an action ready to carry the wounded from off the field to the medical attendants.

However, the first traces of field hospitals in the east, which appear to be discovered, occur no earlier than in the sixth century; when the Emperor Mauricius had with his army the above named *deputati*, whose duty he expressly describes, as does also Leo VI. in the ninth century, who copied many things verbatim from the works of that prince.

From what has appeared, we contend, that it is sufficiently established that there was some regular station, where what are now known as the *staff* of an army, were to be found on the field of battle; that this staff, or medical board, consisted of physicians, surgeons, &c. known as *exercitus medicus*, *medicus cohortis*, and *medicus legionis*, or else why the *deputati* to assist the wounded off the field; or had the medical people been dispersed through the army, those last named assistants would have sought them in vain with the wounded. That *station*, wherever it was, constituted the FIELD HOSPITAL.

It is remarked by Möhsen, that though an order was made in the convention of Ratisbon, in 742, that every commander of an army should have along with him in the field two bishops, with priests and chaplains, and every colonel be attended by a confessor, no mention whatever is made of field hospitals, or any surgeons belonging to the first Christian armies, in the writings of the middle ages. It may, however, be seen, from the works of *Paracelsus*, *Thurneyser*, *Lottich*, and other medical men, that they were present at battles and sieges; but it certainly does not appear they had an appointment in a medical capacity. Another remark of Möhsen occurs upon this subject, which we shall transcribe; that a field surgeon, in the beginning of the fifteenth century, was destined rather for the service of the officers and chief commanders, than for the service of the field hospital: their number being much too small for a whole army. And as their commission authorised them to receive prisoners and plunder, and, like the knights, to convey with them a given number of archers into the field, it has been conjectured, that to fight formed also a part of their duty. Which circumstances appear exemplified in a relation with which *Rymer*, in *Fædera*, furnishes us, in the 4th vol. p. 116 and 117. He says, “ When Henry V. of England carried on war in France, in 1415, he took into his service Nicholas Colnet, as field surgeon, for a

year. He was bound to carry with him three archers on horseback, and to accompany the King wherever he went. In return, he was to receive yearly forty marks, or pounds, to be paid at the rate of ten marks every quarter. He was allowed twelve pennies per day for subsistence money, and each of his archers had twenty marks a year, and six pennies daily for subsistence. The chief army surgeon, Morstede, was engaged with fifteen men, three of whom were to be archers, and the remaining twelve surgeons. He received also ten pounds quarterly as pay, and twelve pennies daily for subsistence. His archers and surgeons were placed on an equal footing; each was to receive quarterly five pounds, and six pennies a day subsistence. Both Colnet and Morstede could receive prisoners and plunder; but when the latter amounted to above twenty pounds in value, one-third to be given to the King. Both these men had a quarter's pay in advance; and that they might always have security for the next quarter, the King engaged to put into their hands, by way of pledge, as many jewels, or other articles, as might be equivalent to one quarter's pay and subsistence."

The Rev. Walter Harte, in his life of Gustavus Adolphus, appears to believe that this prince first appointed four surgeons to each regiment, which he reduced from the number of two or three thousand, first to 1200, and afterwards to 1008; and he is of opinion, that it may with certainty be believed, that the imperial troops at that time had no surgeons, because that Tilly himself, after the battle of Leipsic, was obliged to cause his own wounds to be dressed by a surgeon established at Halle. He informs his readers, in a note, that the Austrians, till the year 1718, had no regimental surgeons appointed. A German historian of eminence himself is obliged to admit, that, however this may be, it is certain that the field establishments of the Imperial army, till the beginning of the eighteenth century, were upon a very bad footing. Even in the year 1718, they had no field surgeons; at this period the company surgeons were dismissed, and a regimental surgeon, with six assistants, was appointed to each regiment; and besides the field medicine chest, surgical instruments were provided at the Emperor's expense.

But it should be added, in justice to German policy, that it really does appear in what Fronsperger says, who wrote in the middle of the sixteenth century, that he does not speak of field surgeons, army surgeons, and their servants, as then recently introduced, but expresses himself in a manner

that indicates they had been common before that time. From him it appears necessary there should be along with the commander-in-chief, or, as the moderns express themselves, the staff, a field surgeon in chief, a doctor, who had the inspection of the field surgeons, the barbers, and their servants, whose duty was to drag the wounded from the heaps of slain, and to convey them to the former. He was obliged to keep by him instruments and medicines, and at each muster to examine the instruments and apparatus of the field surgeons; he decided also, in disputed cases, how much the soldiers, whose wounds had been cured, ought to pay the field surgeons. During marches he was bound to remain with the commander-in-chief. This author also adds, there ought to be with the artillery in the field, a surgeon to that branch of the service; and with each company a particular field surgeon, not a paltry beard-scraper, (*bart-scherer*,) but a regularly instructed, experienced, and well-practised man, who was to accompany the ensign with able servants, and for which he received double pay.

HUNGARY WATER.

Hungary water is an aqueous spirit distilled from rosemary, which only contains the oily and strongly scented essence of the plant. To be really good, the spirit of wine wherewith it is made ought to be very strong, and the rosemary very fresh, and it should be made when the plant is in flower; provided it be so, and quite fresh, the leaves may be used as well as the flowers, which, according to the prescription, should be only employed. It is likewise necessary that the spirit of wine should be distilled several times upon the rosemary. But that process is too troublesome and expensive for that made for sale, which is generally prepared from common brandy, mixed with the essence of rosemary, in the simplest manner. In general it is only mixed with a few drops of the oil. This article is usually brought from France, where it is manufactured, particularly at Beaucaille, Montpellier, and other places in Languedoc, in which that plant grows in great abundance.

Its name, *l'eau de la Reine d'Hongrie*, seems to imply that this water, so celebrated for medicinal virtues, is an Hungarian production. The story of its original, although preserved in several books, common on the continent, appears so much in the character of romance, or legendary narrative, that it will scarcely bear repetition. It is reported that it

was given to a Queen of Hungary, by a hermit or youth, or, as has been said, by an angel, who appeared to her in a garden, all entrance to which, she says, was shut. Some call this Queen St. Isabella;¹ but those who pretend to know the circumstance better, say that Elizabeth, wife of Charles Robert, King of Hungary, who was the daughter of Uladislau II. King of Poland, and who died 1380 or 1381, was the inventress, and who, by often washing with this spirit of rosemary, when in her seventieth year, was cured of the gout and a general lameness; so that she not only lived to see above eighty, but withal became so lively and cheerful, and even beautiful, that she was courted at that age by a Polish king, then a widower, who wished to make her his second wife.

John George Hoyer² says, that a receipt for preparing this water, written by the Queen's own hand, in golden characters, is still preserved in the Imperial library at Vienna; but others have observed, that Hoyer is mistaken in the account he has given of this receipt. It is to be found, as we have been informed, in a small book of John Prevot, which, after his death in 1631, was published by his sons at Frankfort, in 1659.³ Prevot, in those writings betrays a

¹ *Traité de la Chemie*, par N. le Febure. Leyde, 1669, 2 vol. 12mo. i. p. 474.

² In his notes to *Blumentrosts Haus-und-reise-apotheke*. Leipzig, 1716, 8vo. cap. 16, p. 47.

³ *Selectiora remedia multiplici usu comprobata, quæ inter secreta medica jure recenseas*. Auctore *Joanne Prævotio*, Rauraco, in Patav. gymnasio olim medicinæ practicæ professore, et horti medici præfecto. Libellus posthumus a *Joan. Bapt. et Theob.* auctoris fil. in lucem editus, 12mo. In the sixth page is the following passage. "For the gout in hands or feet. As the wonderful virtue of the remedy below has been confirmed by many, I shall relate by what good fortune I happened to meet with it. In 1606, I saw among the books of Francis Podacather, a noble Cyprian family, my intimate friend, a very old breviary, which he highly venerated, because it had been presented to his ancestors by St. Elizabeth, the Queen of Hungary, in testimony of friendship. In the beginning of the book is the following recipe, in the Queen's own hand, with this memorandum.

" 'I, Elizabeth, Queen of Hungary, being very infirm and much troubled with the gout, in the seventy-second year of my age, used for a year this receipt, given to me by an ancient hermit, whom I never saw before nor since. It not only cured me of my complaint, but restored my strength, and I appeared to all so beautiful, that the King of Poland asked me in marriage, he being a widower and I a widow. I, however, refused him for the love of my Lord Jesus Christ, from one of whose angels, I believe, I received the remedy as follows:

" '℞. Take of aqua vitæ, four times distilled, three parts, and of the tops and flowers of rosemary, two parts; put these together in a close vessel; let them stand in a gentle heat fifty hours, and then distil them. Take one dram of this in the morning once every week, either in your food or drink, and let your face and the diseased limb be washed with it every morning ' "

In a postscript then is added: "It renovates the strength, brightens the spirits, purifies the marrow and nerves, restores and preserves the sight, and prolongs life." Thus far the breviary. Then comes a confirmation which Prevot furnishes from his own experience.

bias to credulity and superstition; therefore what he says may not be entitled to much credit: but he gives a recipe against the gout in the feet and hands, much the same as that of the Hungarian Queen, and says he found it at the beginning of a breviary, which had belonged to St. Elizabeth, Queen of Hungary, in her own hand-writing. This breviary was in the possession of Francis Podacather, a nobleman from Cyprus, to whose ancestors it had been given as a memorial by the Queen herself.

It is easily seen that Prevot mistook this St. Elizabeth for Elizabeth, the daughter of King Andrew II. who was never Queen of Hungary, but died wife of a landgrave of Thuringia, in 1235. As Hungarian writers inform us, that the wife of King Charles Robert possessed two breviaries, which she disposed of by will, one to her daughter-in-law, and the other to one Clara von Pukur; and after her death, to be the property of a certain monastery at Buda; it is, therefore, not very questionable, but one of these books might have come into the hands of Podacather's family.

It has been rationally conjectured, that this Princess was extremely vain, as well as extremely foolish, to believe herself, and wish to impress posterity with the same weakness, that she, when beyond the grand climacteric, became so sprightly, young, and beautiful, that a royal widower was enamoured of her: this king and widower has been sought for, but in vain. The proposal for a matrimonial union must have occurred about 1370. But Casimir III. brother of the Hungarian Elizabeth, reigned in Poland till that year, and was succeeded by her son Louis, who died in 1382; after which the throne remained vacant for three years.⁴

It must also appear strange, that the name of *aqua vita*, and the practice of distillation from aromatic herbs, should be so well known in Hungary, as in the early part of the fourteenth century: though the contrary cannot be proved, the known ignorance of the most enlightened countries strongly militates against it. Besides, it is singular that Hungary water should not have been noticed by botanists, in the beginning of the seventeenth century, whilst speaking of the properties of this herb and other simples. It, however, must be confessed, that as early as in the sixteenth century, *Zapata*, an Italian physician, taught the method of preparing spirit of rosemary,⁵ and he says it was imperfectly

⁴ Hubner's Genealogische tabellen, i. p. 95.

⁵ Recipe igitur mustum bonum, scilicet lixivium sponte defluens, antequam calcentur uvæ; cui vasi commisso, adde statim cymatum et foliorum rorismarini

known to *Arnoldus de Villa Nova*. But does not say, it was an Hungarian invention; being silent upon that circumstance.

HYDROMETERS.

The Hydrometer is an instrument for admeasuring liquids; its Greek name is ὑδροσκοπιον, *hydroscopium*, also called *hygroscopium*, *hygrobaroscopium*, *areometrum*, and *baryllion*. It is an instrument by which the strength or specific gravity of different fluids is discovered, by the depth to which it sinks in them. It has been chiefly used for discovering the contents of different salt water, without analysis: and is now chiefly used by those whose concerns are in the spirit trade, to discover the different degrees of strength, and what alloy they will bear; hence its utility to the manufacturer and to the excise officer, is apparent.

The laws respecting the comparative weight of different fluids, as well as of solid bodies immersed in them, was, we may recollect, first discovered by that great geometrician *Archimedes*, (the occasion being before recounted in a previous article, it shall not be here repeated.) It may be far from improbable that *Archimedes* constructed this instrument himself; in case he did, it must have been invented some few years before his death, which happened 212 years before the Christian era.

The most ancient mention of this instrument, by its specific name, occurs in the fifth century of our era, upon the following occasion. The anecdote is very singular and affecting, and also evinces the incapacity of humanity to act consistent and as it ought, when we suffer ourselves to be directed by passions unworthy of the human character.

It is first discovered in those letters of *Synesius* to the philosophic and beautiful *Hypatia*; we trust we may be excused the liberty we propose to take in detailing this circumstance, it not being generally known; and as its

partem decimam, et sicut cum aliis fieri solet vinis, scutella perforata tegatur, ut effervescat et roris marini virtutes extrahat. Si vero lubet, postquam aliquid musti et roris marini in cucurbita vitrea, cujus beneficio alias quinta essentia est distillanda, simul ebullierit, quintam essentiam inde elicere; id fieri poterit; et postquam distillata fuerit, in vas mustum alterum cum roremarino, jam continens, post hujus fermentationem, est infundenda. Addita enim tam modica quintæ essentiæ hac quantitate, mustum eo fragrantius et efficacius reddetur. *Joh. Bapt. Zapata, Medici Romani, Mirabilia seu secreta Medico-Chirurgica - - per Davidem Spleissium. Ulmiæ, 1696.*

interest also recommends it, this furnishes an addition to our motive. Hypatia was the daughter of *Theon*, an eminent mathematician of Alexandria, some of whose writings are still extant. By her father she was instructed in the mathematics, and from other great men, who at that time abounded in Alexandria, she learnt the Platonic and Aristotelian philosophy, and acquired such a complete knowledge of these sciences, that she taught them publicly with the greatest applause. She was young and beautiful, had a personable figure, was sprightly and agreeable in conversation, though at the same time modest; and she possessed the most rigid virtue which was proof against every temptation. She conducted herself with so much propriety towards her lovers, that they never could obtain more than the pleasure of her company and of hearing her discourse; and with this, which they considered as an honour, they were contented. Those who were so daring as to desire further communion, she dismissed; and even destroyed the appetite of one of her admirers, who would not suffer her to philosophise, by means of some strong preparation, which others appear not to have since imitated.

She suffered so cruel a death, that had she been a Christian, and suffered from Pagan error, her name would have been ranked among its most honoured victims in the list of martyrology; but being a Pagan, and suffering from the persecution of superstitious and anti-Christian bigoted zeal, she is honoured among the foremost of martyrs to celestial philosophy.

The name of the Christian patriarch, at that period in Alexandria, was Cyrill, whose family had for upwards of a hundred years before his time produced bishops, who had been much more serviceable to their own respective connexions than they had promoted the Christian faith. The present prelate was proud, litigious, and revengeful, vindictive and intolerant to the last degree; his ignorance debasing his own character, and scandalising the religion of which he was so unworthy a professor. He stupidly conceived himself to be sanctioned in every thing which his foolish and mistaken ideas might dictate to be for the glory of God, and acted as persecutor, prosecutor, judge, and executioner: he had condemned *Nestorius* without hearing his defence. As the city of Alexandria was then very flourishing on account of its commerce with the whole world, the Emperor had there allowed greater toleration and more peculiar privileges to all religions, than in any other place; it consequently contained, among others, a great

many Jews, who carried on a most extensive trade, as well as a great number of Pagan families. In the eyes of the bigot Cyrill, this was not proper; he would have the sheep-fold clean, and the Jews must be banished. *Orestes*, the governor, however, who was a man of prudence and sober discretion, much better acquainted with the real interests of the city, opposed a measure he saw so replete with mischief, and even caused to be condemned to death, a Christian profligate, who had injured the Jews. This malefactor was, by the special order of Cyrill, buried in the church as a martyr; and he collected an army of five hundred lazy monks, who ill-treated the governor in the streets, and excited an insurrection among the people against the Jews, and expelled them from a city where they had existed from the time of Alexander the Great.

Cyrill, one day, whilst looking for objects of persecution, saw a number of carriages, attended with servants, belonging to the first families in the city, before a certain house. Inquiring what was the cause of the assembly, he was informed, that it was the habitation of the lovely Hypatia, who, on account of her extensive learning and very eminent talents, was visited by people of the first respectability, even by the governor himself. This afforded to the malignant priest, Cyrill, a sufficient object for the exercise of his jealousy against the meritorious, the unoffending, the fair Hypatia. He, from that moment, resolved upon her destruction. Accordingly, he lost not a moment to excite his myrmidons, the monks and priests, those who should have been the ministers of that religion of which they were most unworthy members, to destroy the fair philosopher. They, accordingly, with demoniac rage, and instigated by infernal cruelty, took the earliest opportunity to seize her, hurried her to the church, the temple of peace, which they violated by an offence at which humanity must shudder: they tore the clothes from her beautiful and delicate form; likewise tore the flesh from her bones by potsherds, then dragged her mangled limbs about the city, and eventually burned them.

This horrible tragedy took place in the year 415. The impressions which this event must have made upon people of every persuasion, may be conceived, they admit not description from a feeble pen; but we may ask the question, whether it was a transaction calculated to make converts to that religion?—whose avowed motive and maxim is, in the words of Milton,

“ By winning words, to conquer willing hearts,
“ And make persuasion do the work of fear.”

In some circumstances of the preceding relation, all historians are not agreed, but they generally unite in bestowing deserved praises upon Hypatia, whose memory was long honoured by her grateful and affectionate scholars;¹ among whom was *Synesius*, of a noble Pagan family, who had cultivated philosophy and the mathematics with the utmost ardour, and who had been one of her most intimate friends and followers. On account of his learning and virtue, many eminent talents, and open disposition, the inhabitants of Ptolemais were desirous he should be their bishop, having been previously employed on many public and important concerns with success. After modestly desiring, for a long period, that they would fix their choice upon a more worthy object, they still persisting he assented, upon condition that he was not to be expected to believe in the resurrection, to which he could not, at that time, bring his internal conviction; he suffered himself to be baptized, and became their bishop; he was confirmed by the orthodox patriarch *Theophilus*, the predecessor of Cyrill, to whose jurisdiction Ptolemais belonged: he afterwards renounced his error respecting the resurrection. This learned man evinced his gratitude to Hypatia, by the honourable mention which he made of her in some of his writings still preserved.²

In his fifteenth letter to her, he tells Hypatia, that he was so unfortunate, or found himself so ill, that he wished to use a *hydroscopium*, and he requests that she would cause one to be constructed for him. He says, “It is a cylindrical tube, of the size of a reed or pipe; a line is drawn upon it lengthwise, which is intersected by others, and these point out the weight of water. At the end of the tube is a cone, the base of which is joined to that of the tube, so that both have only one base. This part of the instrument is called *baryllion*. If it be placed in water, it remains in a perpendicular direction, so that one can readily discover by it the weight of the fluid.”³

¹ A more circumstantial account may be found in Ægid. Menagii Histor. Mulier. Philosophic. Lugduni, 1690, 8vo. p. 52: Bruckeri Hist. Critica Philosoph. ii. p. 351; and J. G. Wolfi Fragmenta Mulierum Græcarum, Gottingæ, 1739, 4to. p. 368.

² With respect to Synesius, see Bruckeri Hist. Philos. iii. p. 511; and Fabricii Biblioth. Græca, viii. p. 219, 221. He died anno 431.

³ To afford our learned readers an opportunity to judge for themselves, from the original description, we transcribe this letter, though it may be found entire, with Petau's annotations, in Wolf's Fragmenta Mulier. Græcarum. Οὕτω παννύχιον πεπραγα πονηρας. ὥστε ὑδροσκοπιου μοι δεῖ ἐπιταξον αὐτο χαλκευθηναι τε και συνισθηναι. Σωλην εστι κυλινδρικός, αὐλου και σχήμα και μεγέθος έχων· οὗτος ἐπὶ τινος εὐθείας δέχεται τας κατατομας, αἷς τῶν ὑδάτων τὴν ῥοπὴν ἐξεταζομεν. Εἰπωματιζοι γαρ

Petau, who published the works of *Synesius*, in the year 1640, acknowledges in his annotations that he did not understand this passage. An old scholiast, he says, who had added some illegible words, thought it was a water-clock; but the *clepsydra* was not immersed in water, but filled with it. He therefore conjectured that it might allude to the *chorobates*, which *Vitruvius* describes as an instrument to be employed in levelling; but it appears that *Synesius*, who complained of ill health, could have no occasion for such an instrument. Besides, no part of that instrument he describes, has any resemblance to the one described by *Synesius*.

Petau published his edition of the works of this philosopher, in the time of *Peter de Fermat*, *conseiller au parlement de Toulouse*, an excellent mathematician, and a very learned man, well acquainted with antiquities and the works of the ancients. By him there is a learned commentary upon some obscure passages of *Athenæus*, annotations on the writings of *Theon of Smyrna*, and annotations upon a manuscript of the *Stratagemata* of *Polyænus*, which may be found in his *Miscellanies*. *Mursinna*, in his edition of the same author, has added them to the end of his preface. As *Fermat* was often consulted on difficult passages of the ancients, he could not have been unacquainted with that in the new edition of *Synesius*; he accordingly explained it in a written description, which he gave to a friend, by whom it was published in *Bened. Castelli's* book *Della Misura dell' Acque correnti*. *Fermat* died anno 1665; subsequent to his death his son published some of his posthumous writings, under the title of *Varia Opera Mathematica*;⁴ in which collection appears the above treatise on the *hydroscopium*.

From this work of *Fermat*, the following explanation concerning the *hydroscopium* of *Archimedes*, and the *choro-*

αὐτον εκ θατερου κωνος κατα δεσιν ισην εγκειμενος ωστ' ειναι κινηνη βασιν αμφοιν του κωνου τε και του σωληνος. Αυτο δη τουτο εστι το Βαρυλλιον. Οταν ουν εις υδωρ καθης τον αυλον, ορθος εστηξει και παρεξει σοι τας κατατομας αριθμειν· αι δε της ροπης εισι γνωρισματα. Eo sum infortunii redaetus, ut hydroscopio opus habeam; jube mihi fabricari ac coemi. Tubulus est cylindri figuram habens, tibie magnitudine forma. Hic in una recta linea incisiones habet, quibus aquarum libramentum cognoscimus. Obturat enim illum altera ex parte conus, æquabili positu insertus, ita ut communis sit amborum basis, conii videlicet atque tubuli. Hoc ipsum est, quod Baryllium appellant. Jam cum tubulum in aquam deposueris, erectus subit, ut in eo incisiones facile numerare possis, ex quibus libramentum cognoscitur.

⁴ *Varia Opera Mathematica* D. Petri de Fermat, senatoris Tolosani. Accesserunt quædam ejusdem epistolæ. Tolosæ, 1679, 210 pages folio.

bates mentioned by Vitruvius, is given, as it was considered that this article would have been incomplete without it.

“It is impossible,” says he, “that the *hydroscopium*⁵ could be the level or *chorobates* of Vitruvius, for the lines on the latter were perpendicular to the horizon, whereas the lines on the former were parallel to it. The *hydroscopium* was undoubtedly an hydrometer of the simplest construction. The tube may be made of copper, and open at the top; but at the other end, which, when used, is the lowest, it must terminate with a cone, the base of which is added to that of the tube. Lengthwise, along the tube, are drawn two lines, which are intersected by others, and the more numerous these divisions are, the instrument will be so much the more correct. When placed in water, it sinks to a certain depth, which will be marked by the cross lines, and which will be greater in proportion to the lightness of water.”⁶ A figure, which is added,⁷ might have been dispensed with. When a common friend of Fermat and Petau showed it to the latter, he considered it to be so just, that he wished to have an opportunity of introducing it in a new edition.

Mersenne, we understand, disputed the description given by Fermat, and although known to him, never mentioned his name; nor indeed did he allude to his illustrative description, but his objections appear to be without foundation, frivolous and groundless, easy to be confuted by the least knowledge of nature and of ancient customs. Want of room and their unimportance, prevents our submitting them to the public.

INDIGO.

Indigo is a pigment, and, as its name imports, the produce of that portion of the Asiatic continent called *India*.

Probability greatly favours the belief that it was brought to Europe as early as the period of *Dioscorides* and *Pliny*, where it was used as a blue pigment for dyeing and painting. It is most true, all blue colours which were then and which have since been used, might not have been this Indian production;

⁵ See Journal des Sçavans, for Jan. 1679.

⁶ Fermat here remarks, that *πορην*, which has been desired to be changed, should be retained, but that it should not be translated by *libramentum* but *momen-tum*. In a mechanical sense it signifies the weight; and on this account the books of Archimedes de *Æquiponderantibus* are called *ισορροπικων*.

⁷ See also Journal des Sçavans.

although, it should seem, that under this name is comprehended every colour of that description which was formerly known; and which was separated from vegetable produce by fermentation, and afterwards converted into a friable substance by desiccation. However, it must now be understood, that the preparation made from that species of plants, denominated by botanical writers *Indigofera tinctoria*, should be alone considered. Because the various substances, from whence indigo has been procured by our dyers and merchants, are much more numerous; as indigo is said to be prepared from so vast a number of plants, that they are not of the same species, or even family.

Anciently, and indeed till the discovery of the transatlantic world, all the indigo employed in Europe, came from India by land, like all other Indian produce; and till the Portuguese effected a passage round the African peninsula, it was brought from the Gulf of Ormus to Alexandria, thence to Venice, Leghorn, Marseilles, and other European ports¹ up the Mediterranean. We believe it was long considered as an Arabian produce. European ignorance need not be wondered at, because the Arabians had been for many centuries eminent for their chymical skill. In the like situation was the knowledge of the Indians respecting smalt, which the Dutch obtained originally from Saxony, they having manufactured it, sold it from their Batavian and Javanese warehouses to various parts of India.

From a passage we have before cited in a preceding article, the ignorance of even modern Europeans as to the specific nature of this pigment, may be appreciated; by which it will appear the more extraordinary, considering the observation was made by a physical character, and even the very book which professedly treats of the detection of general error.² The circumstance to which we allude, is what was before observed with respect to China, or *porcelain* ware.

It is believed, that what Dioscorides calls *indicon*,³ and Pliny and Vitruvius denominate *indicum*,⁴ is the same we call *indigo*. This is the more believed, as they, Dioscorides and Pliny, describe it as a costly drug, and also that it was used in painting. When pulverized it yielded a black colour; and when diluted in water, afforded an agree-

¹ Sometimes it was brought through the Persian Gulf, and partly by land to Babylon, or through Arabia and up the Arabian Gulf to Egypt, from Alexandria it was usually transported to various European ports.

² Sir T. Brown's *Pseudodoxia Epidemica*, b. ii. p. 98, *ut supra*.

³ Dioscorides, lib. v. cap. 107, p. 366.

⁴ Pliny, lib. xxxv. cap. 6, § 27, p. 688.

able mixture of blue and purple. It belonged to the costly dye stuffs, and was often adulterated with earth. On that account, what was without any roughness, and which resembled an inspissated juice, was the most esteemed.

Arrian also speaks of a black *indicon*. *Hippocrates* also mentions *indicon*, with respect to its medical properties.

The description of the properties of indicum by the ancients, appears to agree in every instance with the article known to the moderns as *indigo*. It appears to be the produce of the districts *Gudscharat*, or *Gutscherad*, and *Cambaye*, or *Cambaya*, from whence it seems to have been brought to Europe from the most ancient times, as an article of merchandize, and also to have retained its old name; which also appears to prove that it is the same identical commodity. What the ancients have said of the colour of indigo, when reduced to powder, is also true; but with respect to its colour, when they say, if mixed with water, the tincture is partly blue and partly purple; of the latter tint, we must understand an agreeable violet, not scarlet. Good indigo is also soft or smooth to the touch when pounded; it floats on the water, as *Pliny* has described it. The test of fire, which *Pliny* recommends, is also known now to be the most effectual criterion to prove its unadulterated state; if pure and free from commixture, it is all consumed, leaving only some ashes: but if mixed, and particularly with earth, as was often the case with the ancients, they having it sometimes imposed upon them mixed with fine Samian clay, when the latter substance remained after ignition.

With respect to its slight marine effluvia, also alluded unto by the writers before named, they believed it to be produced from a marine solution; and we know the force of a previous impression goes far towards confirming our belief.

This article, from its long carriage by land, must have been to the ancients assuredly very dear; and their painters, not being like many of ours, so easy in circumstances as to keep this valuable drug by them, those who employed them, we understand, were often obliged to purchase that and other expensive colours they had occasion to use in their works. Indigo also remained dear, even after it had been conveyed by water, till the discovery was made that it could be procured from the west. Its consumption was also decreased among us, after the discovery of Prussian blue, which it was found might be employed in painting often in its stead; although this last named colour is not so sufficiently dark as the former to supply its place in every instance, to name only extreme dark tints, and also in

shades, indigo cannot be dispensed with where its hue should appear.

The last named pigment, smalt, we understand, will not harmonize with other colours in oil painting, so well as will indigo. With reference to the view Dioscorides took of indicon, from the circumstance of its being prepared in copper vessels, it may not be safe to use it at all times as an internal medicine; and such are the advantages which modern chymistry has secured to us, that discoveries of other medicines are made which answer those purposes much better.

Dioscorides also names another kind of indigo, which, he says, was the coloured scum of the dye-pans, dried. This account has been, heretofore, considered by commentators as merely conjectural in that naturalist. A blue pigment, however, and one remarkably fine, if the previous preparations had been properly made, will be found to result from this process. It is true, it is not indigo, but certainly very nearly of a similar nature.

A certain fine and valuable powder, sold at present under the name of blue carmine, the preparation of which is not yet properly ascertained, is conjectured to be produced in this manner: in the liquor of a blue dye-pan, are observed to float the finer particles of many colours; among these the ancient Tyrian purple. So that the description of *Dioscorides* appears perfectly clear; especially as it is proved this pigment may be collected from a dye made from woad; and as those dyers, at the end of the sixteenth century, we are told, separated from their pans a colouring substance, they sold in the stead of indigo.

In establishments for dyeing black, in ancient times, the scum was collected for a black pigment, which practice appears to have been quite common. Why, then, should not a purple dye have been collected in the same manner, but to form purple-coloured carmine.

It also appears quite evident, that the *Indicum nigrum* of Pliny, was what we, at present, use under the name of Indian ink. Vitruvius also expresses himself in nearly similar terms with Pliny. For, he says, the ancients had huts, in which they burnt pine-wood, where the smoke being collected, they formed lamp-black from it, which, he says, if properly made, as well as ivory black, formed as good a colour and made nearly as good ink as the *Indicum*.

The ancients, it also appears, had a favourite black from the same process which the moderns now use to obtain their *poir de vigne*, or Frankfort black, which our copper-plate

printers prefer to all others. This colour was and is still prepared from the soot taken from where the refuse of grapes are burnt; nay, sometimes the refuse is only charred, pulverized finely, and packed up for sale.

The commentators, therefore, appear, instead of rendering more intelligible the passages of certain ancient authors, to have, by their misconception of their meanings, rendered what they left clear very confused; because the ancients certainly knew, as well as the moderns, the difference between blue and black!

To draw to a conclusion of this article, we observe, that we are credibly informed, that in a work, published by the learned Dr. William van Ranouw, of Amsterdam, intituled, *Kabinet der Natuurlyke Historien, wetenschappen, konsten en handwerken*, in eight parts, small 8vo. between 1719 and 1727; in the seventh part, there is an excellent dissertation, containing the history, preparation, and use of indigo.

Indigo is, we understand, prepared from the fermentation of a plant or herb, called *anil*, the produce of the district of Guzurat, in India, at which place there are large quantities of it prepared; and in other Indian provinces. It is made by throwing large quantities of this plant into still ponds of water, where it ferments with a most intolerable stench, somewhat similar to that of flax-pits; a scum rises upon the surface of the water, and adheres to the banks, which being collected and dried, constitutes the article known by the name of INDIGO.

JUGGLERS.¹

Proposing to say something upon this very ingenious art, if an art it may be called,—a practice then so universally used and so generally approved, that whenever its artists appear, people would willingly part with their money to have their senses deceived. This part of our subject, on impartial consideration, will be found to include so extensive a circle, that, generally speaking, it appears to embrace a great part of our species, even our whole race may be divided into the jugglers and the juggled: what shall we call it, an *art* or a *science*?—no; it can be called neither, for a variety of reasons.

Much has been said upon the immorality, or rather the

¹ Wherever it is thought the officers of religion are irreverently spoken of, it will be remembered, that the application is only made to the worthless and depraved.

impolicy of encouraging jugglers, or that description of people generally recognised as such; but really there seems much to be said in their behalf.

Jugglers then, properly so called, and generally understood, should comprehend all those who, for the sake of money, perform tricks by quick and artful motion of their hands, arms, body, and limbs, to delude the senses, or deceive perception in an agreeable manner; or which includes those who practice deception on spectators, so they think they see and hear, and sometimes feel, what they really do not either hear, see, or feel. In either sense, the practice appears to be of the most remote antiquity, nearly coeval with the species. It is, therefore, in vain to look for the era of its invention. Instances might be adduced to prove, that nearly the whole history of man is composed of the feats of jugglers, consisting of religious and political, and legal deceptions; but, at present, our time and paper is too valuable to be wasted in such researches. It may, notwithstanding, be worth while to inquire into the antiquity of those occupations which have been held to be unprofitable to the public, and which form the favourite amusement of the populace. Believing, trusting, and hoping, that some good may be the result, more than what meets a vulgar eye, we proceed, regardless of the sneers of the critic, or the exceptions of the fastidious: no; we have seen too much juggling, to regard either seriously.

There are arts which are of real utility, and those were the earliest introduced into society; which were conducive to individual comfort and to general happiness: but a period arrived when those were all invented, and when there were more hands brought into the world than could be employed in all those useful arts; what was then to be done?—those supernumerary hands must be maintained,—they must be employed. It was soon discovered that man, after he had fatigued himself with labour, and also many who had no share in this labour, whose time hung heavy on their hands, and for want of mental or corporeal employment, felt most miserable. Those additional and apparently useless hands, therefore, devised means to participate of the goods their various fellow creatures had been labouring for, or which some enjoyed in superfluity, by *amusing* them: the proposal was made, to which the others assented; therefore there is no appearance of injustice. Hence arose tribes of authors, artists, tragedians, comedians, divines, and even politicians, and last of all, though not least, JUGGLERS, *properly so called*. All these amuse the senses of general society, in one way or other; some exercise the patience,

whilst others torture the understanding. But he is the most successful juggler who performs his feats with the greatest ease to himself.

Those arts, as they have been called, are indeed not unprofitable, affording a comfortable subsistence to many who practise them;—sometimes, nay generally, to the most successful; and this is the certain criterion, their gain is acquired by too little labour to be hoarded up: and, in general, those itinerant people spend on the spot the fruits of their ingenuity, which, by-the-bye, affords an additional reason why their art should be encouraged, and their stay in a place prolonged; as it is on all hands agreed, that the circulation of money makes good for the general common weal: the only unprofitable wretch to society, is he who cannot have the heart to circulate his money.

The people thus disposed, jugglers will not want encouragement or support, whilst they exhibit with confidence, and suit their spectacles to the prevailing taste of the times; and the people among whom they show their exploits. The major part of mankind love deception so much, that they reward liberally those who impose the best upon their senses, and cheat them of their understanding, in the most specious and plausible manner. The ready encouragement which certain dogmatists in religion, empirics in the practice of physic, and other serious professions meet with, afford a ready proof of this. Should not the avidity with which gilt toys and artificial gems are sought by children, afford conviction; and pray what is man?—but an overgrown-child.

Jugglers, properly speaking, seldom exhibit any thing which can appear wonderful to those acquainted with the sciences and mathematics; but these often find satisfaction in seeing truths already known to them, applied in a new manner: and they readily embrace every opportunity of having them illustrated by experiments. In fact, it often happens, that what ignorant persons first employ as a mere exhibition, is afterwards ennobled by being applied to more important purposes. Such has been the case with a great variety of mechanical exhibitions. The machine exhibited by an ignorant Savoyard, to produce change of shades for the amusement of children, is said to have furnished the able optician *Liberkühn*, with the idea of constructing a solar microscope.

It has been said, and with truth, that if the art of juggling served for no other beneficial end than to amuse the most industrious, as well as the poorest part of the community, who cannot afford the expensive amusement at the opera,

where the Italian jugglers perform, or even a place in the two shilling gallery of our theatres, yet such people should be, indeed, diverted, and not deprived of the rights and privileges of freemen: were they to be denied the annual pleasure to see the able necromancer, *Sieur Gynge*, perform his admirable tricks at Bartholomew fair, the good people of the British metropolis would consider it a serious infringement upon their natural privileges.

Thus Anna, Dido's sister, had early discovered the cheats of the juggler's art, and hence expresses herself:

*Heu! sacri valum errores numina nobis,
Elicunt, spondent que novis medicumme cusis.*

“ O, soothing priestcraft! O the close disguise
“ Of cheat, imposture, and well varnish'd lies!
“ With a pretended zeal, the shades they implore,
“ The gods of night, demurely they adore;
“ With promis'd cures, they gull our easy minds,
“ A solemn vow, which holy knavery binds.”

It is said, that when Gasner exhibited his deceptions in Germany, he was advised to try his art at Berlin or Göttingen, and drive out there, if it were possible, one of the smallest of their devils; but since those cities were not theatres where he was likely to succeed, he did not venture to appear in them.

It would be, however, much better, if the populace are determined absolutely to pay for being deceived, they should be exposed to the momentary deception of jugglers, than to a continual deception from their fellow men in whom they confide. Their deceptions are more easily seen through and detected; and, consequently, they soon cease to become hurtful. As late as 1601, a horse, which had been taught to perform a number of tricks, was tried as *one possessed of a devil*, and actually condemned to be burnt!² At present, however, horses of this kind, and even hogs, are so often publicly exposed in every heretical country of Europe, that the Holy Spanish Inquisition itself, perhaps, would be ashamed of such a prosecution. They might, probably, be advised that the labour of their teachers, and the docility of the animals, merited a better return.

The grave portion of our readers will, we hope, pardon our indulgence in this playful mood; but we hope to illustrate this subject better by the assumption of an innocent

² Beckmann, vol. iii p. 271. This occurred in the dominions of his most Christian Majesty. *Le Siècle de Louis XIV.* Berlin, 1751. The celebrated Casaubon saw this horse. See *Casauboniana*.

levity, when manumitted from the bonds of restraint, than when tied down to dull matter of fact. The effects of the malice of state jugglers may be seen in this: that a juggler of Poland was tortured in Portugal, in the year 1739, till he confessed that he was a *sorcerer*, when he was hanged. Had that book, which Celsus wrote against the Persian Magi, been preserved, it is probable our present inquiry might have been abridged. The same Celsus was a character distinguished for acuteness of intellect, a shrewd and pointed mode of expression, who generally condemned all mental delusion, and abhorred every thing he thought like deception.

Religious Deceptions.—By the art of employing those balls, which the Sicilian revolter Eunus used, about 112 years before the Christian era, as recorded by *Florus*, iii. 19, 4, or that by which modern jugglers use to produce flames from the mouth, by means of burning tow, did the rabbi, *Bar-Cocheba*, in the reign of Hadrian, persuade, in that instance, the credulous Jews to believe he was the looked-for Messias.³ Also the Emperor Constantine experienced a religious dread, at the time Valentinian informed him that he had seen one of the body-guard breathing out flames of fire in the evening.

For deceptions with this element the ancients employed, it is believed, a fine liquid mineral oil, called *naphtha*, which kindles when the flame only approaches it. Galen has said, that great astonishment was excited when a light being extinguished, and held against a wall, the former ignition was revived in all splendour; but, he says, the wall had been rubbed with sulphur: however, it is conjectured, that he having but just before been speaking of a mixture of naphtha and sulphur, that he must have meant this was the composition with which the wall had been anointed.

Plutarch relates how *Alexander the Great* was astonished and delighted at *Ecbatana*, with the secret effects of naphtha. That same author, with Galen, Pliny, and others, have remarked, that the dress which *Medea* presented to *Creusa*, the daughter of *Creon*, for her to marry *Jason* in, was anointed with NAPHTHA, which took fire the moment she approached the flames of the altar. The robe which Nessus gave to *Dejanira*, and which she improvidently sent to her husband *Hercules*, for him to perform sacrifice in, had, doubtless, been covered with naphtha, as well as with the

³ See Bayle's Dictionary, i. p. 450, article *Barcochebas*.

blood of the centaur; and the moment he approached the altar in it, it is conceived it took fire and destroyed him. In his agony he hurled his servant *Lichas* many miles into the *Ægean Sea*.⁴ It is conjectured this oil must have been always employed whenever offerings caught fire in an imperceptible manner.⁵ Thus we see in every period of the world, priests have acted as jugglers among simple and ignorant people, operating by machinery beyond the recognition of sense, and holding the faculties of their votaries in perpetual bondage.

In more modern times, the ordeal by fire was fashionable, particularly among our Anglo-Saxon ancestors, when, whoever could walk over burning coals, and red-hot ploughshares, without hurt, excited wonder, and at the same time proclaimed their own innocence.

Of this ordeal we have in our ancient history and chronicles, the story of the beautiful princess *Emma*, wife of *Edwy*, whom the infamous Saint Dunstan got condemned to this ordeal, because her husband was more devoted to her and domestic happiness, and very properly bore more affection to his lovely wife than that priest thought consistent with the honour due to his God, or to the blind obedience he wished to extort from him to the prevalent superstition of the day. Another flagrant instance of the pride of those ambitious priests.

We thank God we are not acquainted with any thing relating to this mysterious trial by ordeal; and now, for the first time, we regret it, for the sake of exposing such instances of moral delinquency; but we understand, when persons were accused, they were condemned to prove their innocence by holding in their bare hands red hot iron. Those whom the priests wished to free, or favour, and were desirous to work the effect of miraculous agency upon, they previously prepared by three days instruction, except to any of their own order who needed it not; but those others they covered their hands, or feet, as the case might be, and sealed and unsealed the covering, under pretence to prevent any preparation by art; this covering remained upon the parts for three days and nights subsequent to the operation.

A doubt can scarcely be said to exist but that during that period some medicament was applied which is known to

⁴ Vide Ovid. *Metam.*

⁵ Instances may be discovered in Huetii *Alnetanæ* Question. lib. ii. cap. 12, 21, p. 171; and in Bayle's Dictionary, art. *Egnatia*, p. 344.

prevent the effect of the ignitious element upon the flesh. It seems from the confession of the learned and ingenious *Albertus Magnus*, a Dominican monk,⁶ after the abolition of the ordeal, in the thirteenth century, when the necessity for secrecy ceased; and it appears that a kind of paste was prepared, which was made to adhere to the hands or feet, by the glutinous sap of the *althæa* (marsh-mallow,) or the slimy seeds of the flea-bane, which are still used by hat-makers for stiffening hats, with the white of an egg; this made the paste adhere to the feet, or hands, the same as a glove.

It is understood that these ecclesiastical jugglers had the possession of the persons who suffered the trial of ordeal, for three days and nights after the operation:—judged for the purpose of restoring the hands or other parts to their accustomed appearance. Previous to the ceremony of ordeal being performed, they, by way of grimace, sprinkled the hands, &c. and also the iron, with holy water.

It is understood that frequently anointing the hands with oil of vitriol, or strong ley, will render them corneous and extremely hard, insomuch, that the fire will have little effect.

It should have been remarked, that the ceremony of ordeal took place in the church whilst mass was performing; the priests heated the iron themselves, and conducted the whole proceeding, taking care to divert the attention of the congregation as much as in their power; the same as our modern jugglers use precaution to effect a similar purpose.

In the *Antigone* of *Sophocles*, the guards placed over the body of *Polynices*, had suffered it to be carried away and buried, contrary to the orders of the tyrant *Creon*: they offered, to prove their innocence, to submit to any trial: “We will,” said they, “take up red-hot iron in our hands, or walk through fire.”

Ἡμεν δ' εἰσὶν ἐτοιμοὶ καὶ μυδρὸν αἶρεν χερσίν,
καὶ πυρ διερπεῖν, καὶ θεοὺς ὀρκωμοτεῖν
τὸ μὴτε δράσαι, μὴ τε τῷ ξυνεῖδεναι
τὸ πρᾶγμα βουλευσάντι, μὴτ' εἰργασμένῳ.

Antigone, 270, p. 248, ed. Cantabrigiæ, 1665, 8vo.

Vulgar Juggling of the Laity.—The exhibition of cups and balls has always amused the common people; this is one of the most ordinary feats of jugglers; it appears to have been very ancient; it has been noticed in *Xenophon*, by the

⁶ In his work *De Mirabilibus Mundi*, at the end of his book, *De Secretis Mulierum*, Amstelod. 1702, 12mo. p. 100.

term *κλεπτεῖν*, which implies a rapid movement, and with imperceptible swiftness. It consists in conveying speedily, and with great dexterity, whilst the performer endeavours to divert the attention of the spectators from the observance of his motions by various gesticulations and cant phrases, which none can understand, several light balls, according to the pleasure of any one of the company, under one or more cups; removing them sometimes from the whole; and conveying them back again in an imperceptible manner. In general they are thin leaden cups, and as many balls of cork; and to prevent disappointment to the juggler, by their slipping from his thumbs, or making a noise, he must lay hold of them with great dexterity and quickness, and his table must be covered with green cloth.

These small balls the ancients called *calculi*; and the cups *acetabula*, or *paropsides*. *Casaubon* hath already quoted many of those passages in ancient authors which relate to this subject; and *Bulenger* has repeated them: but neither have given the fullest and clearest description.

From the art of oratory deceiving the auditors, it has incurred the same appellation among the ancients, as that of the juggler: from the Latin word *gabata*, mentioned by *Martial*, with *paropsides*, the French from these have made *gobelets*, and say, when speaking of jugglers, *joueur des gobelets*.

Feats of extraordinary Strength.—In all ages there have existed men who have attracted great attention by surprising instances of strength. It is susceptible of proof that above 1500 years ago, there were people who by applying the principles of mechanical powers to their bodies, or placing themselves in such a position as to answer well recognised principles of mechanism, were capable of performing feats, which have even astonished the world; although it is unquestionably true that any man of ordinary corporeal powers, could have performed the same by using similar means.

In the commencement of the last century, or about the end of the century preceding, a man of the name of *Topham* performed wonders in London; he usually exhibited on Tower-hill: he was called *the strong man*. About the same period, or since, a man, who called himself *Sampson*, excited the attention of Germany by the same means; when he fixed himself between a couple of posts upon any level place, two or more horses could not move him; he could break ropes asunder; lift a man up on his knee whilst he remained stretched upon the ground; and could suffer stones to be broken upon his breast. The Roman Emperor *Maxi-*

mus, who possessed uncommon strength of body, insomuch that he could break a horse's jaw with the blow of his fist, break the thigh of the same animal by kicking it, and drag a couple of oxen at his pleasure; but, upon recollection, this man should not be classed with those before described, for his personal strength was equalled by his uncommon size and gigantic stature: his wife's bracelet served him for a thumb ring. His appetite bore an equal proportion to his other powers, having the allowance of forty pounds of flesh and six gallons of wine per day, without a debauch in either. He had been originally a Thracian shepherd; was taken into the body guard of the Emperor Severus; first attracted royal attention by beating sixteen horses following, in running; then having outrun several men, and lastly tired the Emperor's charger.⁵

A feat of the former description of persons was frequently performed by one Firmus, or Firmius, in the fourth century. He was a native of Seleucia in Syria, and he attempted to set himself up as an Emperor of Egypt, but was eventually executed by order of Aurelian. He could suffer a common smith's anvil to be beaten upon his breast, at the same time supporting his weight upon his feet and shoulders, between two pillars, so that he appeared suspended in the air, his body forming an arch; which *Desaguliers* explained in a course of experimental philosophy, delivered in London, anno 1745.

The ancients had several names for different sorts of rope-dancers, as *schænobatæ*, *oribatæ*, *neurobatæ*, *petaminarii*, *funambuli*, &c. which appear to have been given them from the different manner of their performances. Rope-dancers also abounded in the middle ages; in 1237 they were common in Italy; and in 1393 they were at *Augsburg*, in Germany; their pay there was from each spectator, three German halfpence. They sometimes exhibited on ropes suspended from the masts of shipping. The present *Madame Sachi*, astonishes the London people, by ascending or descending a rope reaching from the top of our theatres to the stage, which she performs with her feet alone, carrying lighted flambeaux in her hands.

Equilibrists, are also of the same business, and what are called *wire-dancers*; we have in London, daily, very clever people from all countries, in those bodily exercises; with many dextrous horses in the amphitheatre, Westminster-

road, called *Astley's Amphitheatre*. There are also generally one or more very learned swine, learned dogs, &c. too numerous to particularize their various peculiarities. We have in London most things the world affords; even sometimes the *homo* which was the object of the philosopher's search, with his lantern, may be found.

To place men upon the shoulders of each other in such a manner as to form a pyramid, that each row consists of one man less, till a single man or boy crowns the whole, is a piece of dexterity extremely ancient. It has some resemblance to the Grecian mode of warfare usually employed in scaling walls, which they called *χελωνη testudo*, because the men usually supported their shields upon their heads; thus, they considered them armed like a *tortoise*, whence its name; the second men, who mounted upon the heads of the soldiers forming the ground plan, used their shields in the same manner; another party then mounted upon them, and so on, until they had arrived at the height they wanted. Their shields, covering them like a pent-house, served to ward off such missile annoyances as the besieged might defend themselves with. But a singular, and one of the most extraordinary circumstances of this description we have met with, occurs in the history of the Saracens, who, when the Mahometan army was besieging Aleppo, in the caliphate of Omar, a man, whose name was *Dames*, of gigantic stature, and possessing remarkable cunning, who, when they had lain a long time before the place, discovered they could not force the walls, from their great strength, requested of the commander, *Abu Obediah*, the assistance of thirty other men; which being granted him, he then requested the commander to raise the siege, and remove with his army to about a league distance. In the night *Dames* went out several times, and brought in five or six of the besieged. He afterwards takes from his knapsack, a goat's skin, with which he covered his back and shoulders; took a dry crust in his hand, crept as near to the castle as he could; if he heard any noise, or suspected any person to be near, to prevent being discovered, he could make such a noise with his crust, as a dog makes that is gnawing a bone; the rest of his company came after, sometimes sculking and often creeping along, at other times walking. About sun-rise he sent to his commander to send him some horse; when they came to the castle, they found it inaccessible. However, *Dames* was resolved to leave nothing untried, and before the next night surveyed the walls; and having found a place where he thought he could easiest

get up, he sits down upon the ground, orders another to sit upon his shoulders, and so till seven of them had got on each others shoulders; the uppermost then stood up, as did the remaining, till at length Dames himself stood up, who bore the weight of the whole, except what they might ease him by holding to the wall. By this time, he who was uppermost made shift to reach the top; then they all said, “*O Apostle of God, help us, and deliver us.*” When he was got up, he found a watchman drunk and asleep; him he seized hand and foot, and threw down among the Saracens, &c. so they all ascended, till eventually by this means they took the city.^o

It is also said by *Statius Juvenal*, and others, that the ancients had *petauristæ*, who excited great astonishment among the populace by contortions, tumbling, &c. Cilano explains a well-known passage of *Manilius*, by observing the performers darting through suspended hoops of iron, made red-hot; said to have been different from a wheel mentioned by *Xenophon*, on which a female dancer wrote and read whilst it turned round with great velocity.

Horsemanship was also as common among the ancients as among the moderns, of which there are several extraordinary instances recounted. They could stand on their horses whilst at full gallop; mount and dismount whilst in full speed; tumble on horseback, and perform many wonderful feats. Their chief performers on the horse, all came from Egypt, Syria, or Turkey. In latter ages, these orientlists appear to have been the first who travelled through Europe. Montaigne saw an Italian who had learnt this art in Turkey, and performed in Rome in 1581; and the following year he saw the same person in Paris.

It does not appear whether the ancients taught birds, dogs, hares, and other animals, to perform tricks as at present done for money in Europe; but there is a very singular circumstance recorded of an elephant, that walked backwards and forwards upon a rope, in Rome, which *Galba* first caused to be shown to the people: as recorded by *Dio Cassius*, *Seneca*, and *Suetonius*. It also appears, that in the thirteenth century, there were those who ventured to ride a horse on a rope. The *Sybarites* are reported to have taught their horses to dance to music, as a variety of authors confirm.

We must not omit to mention the skill of our countryman,

^o History of Saracen Conquests, in Alwakidai Syria, Persia, and Egypt.

Wildman, so famous for his management of *bees*, about 1760, that they followed him wherever he went, and clothed every part of his body as in a swarm; his cap being particularly covered, and thousands flying round about him.

Persons also destitute of hands and arms, have performed wonders, at various times, with their feet.

Figures, puppets, and other *automata*, the produce of machinery, have also much amused the world. There are many instances in ancient as well as comparatively modern times, of this; but to mention only *Week's Tarantula spider*, and *Milliardet's* various figures in our days, may serve to confirm belief. The Greeks called such figures *marionettes*. In antiquity, Dædalus was famous, as an artist, in making those.

There has not been a more eminent mechanist among moderns than *Vaucanson*, the Frenchman, who constructed a figure that played on a flute, performed twelve tunes, stopping the holes with its fingers. An eagle is said to have been constructed by one Muller, which flew about, and when the Emperor Maximilian entered Nuremberg, perched on the town-gate, and inclined its head and shoulders in token of submission.

We, ourselves, have actually seen so timid an animal as a hare, in the streets of London, beat a drum with its fore paws, and fire a pistol.

We apologize for the length of this article; but really, to mention every circumstance worth notice, we possess, would extend it to three times the length we have already trespassed. Also, hoping its importance may plead our excuse, on which our opinion is already given.

KITCHEN VEGETABLES.

Under this appellation corn which grows in our fields is not included, but by it is meant to be comprehended all those esculent herbs and roots cultivated in gardens, including also certain species of fruits likewise chiefly the produce of gardens. These productions are partly indigenous, and in part foreign. Among the former, asparagus, several salad herbs, water cresses, swine cress, sorrel, endive, dandelion, garlic, and other herbs of various species, adapted for this purpose; mushrooms, champignons, and others of that nature; hops, plums, cherries, sloes, hips, bramble berries, crabs, and other fruits. These all grow wild, but are occasionally cultivated, and have been for a

long series of years; whereby, the degrees of perfection, according to the attention which has been bestowed upon them; renders them as various as almost to occasion a doubt whether the various individuals are of the same species. The chief of our modern kitchen vegetables were imported hither immediately from Holland, and the Flemish and Spanish Netherlands, so late as the days of Queen Elizabeth; and in fact, long since her time, the court used to be supplied with salads daily from Holland. With King William III. the method of Dutch cultivation in our gardens was introduced.

The inhabitants of those districts, there is occasion to believe, originally received those, the chief of their esculents from Italy; except the potatoe, which we believe to be a production of South America, brought to Ireland from Guayana, or Surinam.

Few were the plants that were originally cultivated in England: the chief, there is room to believe, were the cabbage, turnip, carrot, parsnip, leeks, onions, and some few others: and so slow does improvement advance, in public institutions in particular, that in that excellent public endowment attached to Christ's Hospital, called the Blue Coat School, founded by King Edward VI. the use of that very valuable root, the potatoe, is not yet introduced into general use. There are, doubtless, many as singular anomalies in numerous others of our public institutions, did time permit us to make the inquiry; which would have been done, notwithstanding, but we were apprehensive of meeting no better reward than the unfortunate critic who presented the faults of a contemporary poet to the god of song, expecting a reward: the deity desired him to select the particles of corn from a measure of corn in the chaff; when he had done so, he was presented with the chaff for his pains.

Culture frees plants from their harsh and unpleasant taste, renders them tender, larger, and more nutritive; when these improvements are made, the plant in its wild state is considered unfit for use. Cultivation has also another very material benefit, it causes those plants to be produced in seasons when wild ones will not grow. This, of course, enhances their value greatly.

Many of our foreign plants require most laborious attention to make them thrive in our uncongenial climate; whilst some flourish so well and so readily increase, that they run speedily to wildness in any soil having the inclemency of air, winds, &c. to combat with. Such is their luxuriance that it is

often found difficult to free the land from them ; which is the case with hops, potatoes, horse-radish, parsnips, and the like. Some plants, however, both indigenous and foreign, formerly raised by art, and esteemed at the table, are no longer cultivated, since others more agreeable have in a measure superseded their use. Many served our ancestors in the room of foreign spices, the use of which our trading companies have abolished, much to their advantage, but to our hurt. It is no less true that omnipotent fashion has banished many others, whose tyranny will be obeyed in matters of mere sensitive taste, as well as in that habit which has assumed its name without pretension to similar gratification.

Anciently men were so much attached to sweet things, that the flavour of milk and honey were universally used as a common-place metaphor for all saccharine substances. This ancient mode of judging is still retained in most countries where humanity is not so subject to be vitiated as in European climes, insomuch, that the mode of speech, which this relevant antique practice introduced, is still adhered unto. The lower orders of society in our country appear to retain the same mode of judging ; so that they often apply the term sweetness to what they believe to be wholesome. The same practice is also still observed in northern countries : thus the Swedes spoil, by the addition of sugar, costly Rhenish wine, sour kraut, and other articles, the agreeable tartness of which is gratifying to other nations. In proportion to their population and luxury, the Swedes appear to use more sugar than the Germans, whilst these employ more than the English or French ; so much attached are they to sweets, that their *gout* appears to have equalled, or kept an inverse ratio of culture. At all times, by keeping this reason in view, we may explain why many of the vegetable productions formerly cultivated now become disused. Some centuries ago, these now forgotten vegetables were reckoned among the most agreeable dishes, which to a correct taste now appear nauseously sweet ; thus we are told the Emperor Tiberius was particularly partial to skirret, which he caused to be brought to his table from the Rhine. This is at present little relished, and the same dislike which now prevails against it, also exists with many against parsnips, some species of apples, and other things. Fashion also, sometimes, recalls into use, things which it had formerly suffered to experience neglect, as well in spices, as in herbs and roots themselves. Whenever any thing is thus again requested, it is inquired for under a new name. This was the case with monks'-rhubarb ;

after laying dormant for many years, it was again cultivated under a different appellation, and has been recommended to supplant the very savory spinage. Bock, we understand, alleges, that the former was transplanted by the monks, in the middle ages, from the woods into gardens, to which, in Germany, it hath been brought back, under the imposing appellation of English spinage.

Before the commencement of the Christian era, when the enjoyments of sense were under less restraint, nor shackled by religious and political principles, many vegetables, as well as other dishes, were used for various purposes and highly recommended by writers on cookery and horticulture, as well as by their poets and most elegant authors, which none but physicians may even now speak of without incurring the charge of indelicacy, their properties being anciently well known, but from their being disused, their names, which appear in former writers, are alone remembered.

To this principle of Christian refinement, we have to attribute our ignorance respecting numerous receipts in *Apicius*, now no longer to be comprehended even by able interpreters, because their utility is forgotten. Of this kind, are our numerous bulbous roots (*bulbi*), which formed the most favourite dishes of ancient Athens and Rome, which few can now be found who can discriminate to what class of the vegetable kingdom they belonged. However, it does not appear that those rare productions were abandoned because better ones appeared, but the occasion is to be ascribed to the principle before named. The American *vanilla*, perhaps owes its present use with chocolate to its high price, but it certainly does not supply the place of the ancient Megarean bulbs.

*Spargite, quæque viros acuunt, armantque puellis,
Jam Megaris veniant genitalia semina bulbi;
Et quæ sicca legit Getulis obruta glebis,
Et quæ frugifero seritur vicina Priapo,
Excitet ut Veneri tardos eruca maritos.*

COLUMELLA, x. 105.

Among kitchen vegetables, formerly cultivated, at present not esteemed, may be reckoned the following: winter cresses, before spoken of, called in the west of England, *swine cresses*; named by *Kerner*, *erysimum barbarea*, usually eaten whilst young as salad; also common Alexanders, the *Smyrnum olosatrum* of *Kerner*, which in the seventeenth century was used as we now use celery; bulbous chærophyllum, the *chærophyllum bulbosum* of *Kerner*, the roots

of which, we understand, are still brought to the market of Vienna, where the value of palatable things is understood very well, and where they are boiled and eaten with vinegar and oil. *Rampion*, the *Phyteuma spicata* of *Kerner*, was formerly used in the same manner. The earth-nut, growing wild in many German districts, is, we have understood, still cultivated in Holland, and on the banks of the Rhine, which *Kerner* calls *Lathyrus tuberosus*. Rocket, called by the same naturalist, *brassica eruca*, in Italian *ruchetta*; also by *Kerner*, *brass. erucastrum*, the young leaves of which were formerly eaten as salad, but now no longer esteemed, partly on account of its nauseous smell, and partly on account of its harsh taste, which resembles that of rancid bacon; it is, however, still retained in Italy, *excitet ut Veneri tardos eruca maritos*.¹ Vetches, are also now banished our gardens, anciently called *lathyrus sativus*, and *cicera*, experience having shown they were prejudicial to health. Pepper was once so dear, that if a religious devotee promised a saint yearly a pound of it, it was looked upon as a liberal bequest, when economical housewives seasoned their dishes with the leaves of pepper-wort, *lepidium latifolium*, which on that account was called *poor man's pepper*.

Borage, the *borago officinalis* of *Kerner*, since the fourteenth, or at least the fifteenth century, has been sown, not only for medicinal purposes, but for the use of the table. The young leaves, which soon become hard, rough, and unfit for the table, are used in soup, whilst the beautiful blue flowers are put into salad and wine. This plant, or at least its alleged virtues, were not known to the ancients, although it has been conjectured to have been what they called *buglossum*. It seems probable that it was not what *Nicholas Myrepsus*, who flourished in the beginning of the fourteenth century, names *πουργανιον*, which has been thought to be *borago*: see the opinions of old botanists, collected in *Bauhini Hist. Plant.* xxxiii. 2. p. 574. Some botanists have conjectured the word is derived from *corago*, given by *Apuleius*, as a synonym of *buglossum*. It appears, from what has been said on this name, that *corago* is the proper name, deduced from the alleged property of the herb, strengthening and fortifying the heart; whence, we presume, the custom of the *cool tankard*, consisting of wine with this herb infused, which it is usual for the keeper of the

¹ Columella, x. 109. Virgil. *Moretum* 85: Venerem revocans eruca morantem.

gaol of Newgate to give to the Lord Mayor of London, the sheriffs, and attendants, previous to proclaiming the fair of Saint Bartholomew, is derived, we suppose, from the circumstance of Sir W. Walworth meeting the rebel *Wat Tyler* on the same spot, where he slew him, anno 1382. It certainly appears extremely probable that our forefathers, acting under the impression that their *buglossum*, or our borage, had the property of fortifying the heart, threw the flowers into the wine, that their spirits might be more enlivened. Cæsalpinus says, it was brought from other countries to Italy. Linnæus positively states that it came originally from Aleppo; upon what authority he made this assertion has not been discovered.

It is said spinage, called by *Kerner*, *spinacea oleracea*, is among those vegetables of which no trace of their name is to be discovered in antiquity. Its native country is unknown. The name is new, and derived from the prickly nature of its seeds. It was first used by monks, and eaten on days on which they should have fasted. At that time, it was written *spinargium* or *spinachium*. Meursius found in the middle ages *σπιναχιον*, in a poem which has been often mentioned, but not with sufficient accuracy defined. This plant appears to have come first from Spain. Bock and other old botanists name it *olus Hispanicum*. Ruelius, and some others, call it *atriplex Hispaniensis*; whilst the Saracens called it *Hispanach*, which expression of theirs implies a Spanish plant. The properties assigned to this plant are, that it is insipid, on which account the addition of pepper and vinegar are necessary to render it palatable; that it is readily multiplied, is indigestible, and gently aperient. This characterises its known properties with several other plants, as beet, orach, and a plant known as the good king Henry, the *chenopodium*, *bonus Henricus* of *Kerner*, the young leaves of which are dressed in Germany as spinage. It is also probable, from a similarity of properties, that the *blitum* of the ancients may have been a kind of *amaranthus*, some species of which are known to be eatable. *Blitum* may, therefore, remain as difficult to be defined as *malva*, which was used at the same time.

The *brassicæ* of the ancients belong certainly to the cabbage genus; yet it appears that no one has yet proved their identity. We presume it is the large-leaved, thick, and blue or purple coloured kind of *wort*, said to have been sufficiently large to make a covering for the posteriors; from *bracca*, breeches, slops, or brogues, or any thick and coarse cloth.

It might, indeed, be attended with much unprofitable labour to attempt to trace out the cabbage genus of the ancients. There appears, however, to be one species now recognised, as well known to antiquity, *i. e.* the *colewort*, famous for its presumed nutritive qualities, yielding much milk to nurses and women bearing children: see *Potter's Greece*, article *child-bearing*; although we do not know it is now so appreciated. The ancients had also a species of cabbage, the leaves of which, if eaten, they allege would prevent intoxication; this species appears unknown in modern times. They chopped it, and eat it raw like salad. It has been also surmised, that the ancients were not acquainted with our cabbage, yet there are many sorts eaten raw with us after pickling; a species, called by Pliny *lacuturris*, has been considered by *Ruellius*, and not improbably, it appears, that this was that species: see *Collumella*, x. 138. *Plin.* xix. 8. sect. 41. No mention of *red-cabbage* appears among ancient authors.

It does not appear that the ancients knew the art of the present Germans, in causing the vinous fermentation to take place in vegetables, for the purpose of manufacturing what they call *sour kraut*; though it certainly does appear they knew how to prepare turnips to answer the same purpose, and it is said in the same manner the Germans exercise their art in the production of sour cabbage. Sour kraut has been considered by the Germans as an invention of their neighbours the Saxons; they have said it was first made in Lower Saxony; this would still have been believed had not Bellon, in his *Observat. Itiner.* iii. 27, p. 186, assured the former people that he found it in Turkey; the inhabitants of which are accustomed to pickle it for their winter food. It appears, that this people take the whole heads, as in Germany, but particularly in Upper more than Lower Saxony; some preserve *kumskohl*, a name, which as well as *compost*, and the French *compote*, Frisch derives with great probability from *compositum*, preserved.

The ancients are supposed to have been acquainted with curled cabbage, and even with some of those kinds which we call *broccoli*. Under this term is understood all those species, the numerous young flowery heads of which, particularly in spring and autumn, can be used like cauliflowers. Such young shoots are called *cymæ*, but not *turiones*; for the latter term denotes the first shoots that arise, like those sprouts of hops, asparagus, and other esculent plants. The *broccoli* used at present, was, however, brought from Italy to France, together with the name, about the end of the sixteenth century.

German cauliflower, about the end of the same century, was brought from the Levant to Italy; and in the end of the seventeenth century, was transplanted from thence to Germany. For a long time the seeds were procured annually from Cyprus, Candia, and Constantinople, by the Venetians and Genoese, who sent them to every part of Europe; because, at that time, the art of raising seed was not understood.¹ Prosper Alpinus, in 1588, found abundance of this vegetable in Egypt, and from his relation there is room to conjecture that it was then very little known in Europe.² Conrad Gesner seems not to have been acquainted with it; at any rate, it is not mentioned by him in a list of the cabbage genus of plants.³ In the time of Bauhin, it must have belonged to those vegetables which were scarce, because he has been so very particular in naming the garden in which he saw it.⁴ Von Hohberg, who wrote about 1682, says, that a cauliflower a few years before had been brought to Germany for the first time.⁵

It would be tediously unprofitable to trace and define every species of the cabbage kind, the leaves and flowers of which were used by the ancients as food; but it would be a task still more arduous to determine those which have esculent roots. There appears but little room for doubt, that all the species of the cabbage originally drew existence from one parent stem; although, it should seem, botanists have not given themselves the trouble to examine the several classes of kitchen vegetables, which would serve the purposes of useful science much more than to form new genera from those of Polynesia. But the Linnæan system describes the following species: First, *brassica oleracea*, to which belong all kinds of leaves and flowers which are esculent. Probability favours the idea, that every species of this genera has originally come from one common parent stock, which it is impossible, at this time, to discover in its simple and primæval state. A similarity is noticed in all the kinds of this plant in some certain particulars: but, not being botanists, we do not feel equal to define it completely, or to

¹ We find this stated in *Vincenzo Tanaro Economica del Cittadino in Villa*, which book was written in 1642, and often printed; the eleventh and last edition, published at Venice, in 1745. See also *Halleri Biblioth. Botan.* i. p. 468; and ii. p. 682. *Lastri Biblioth. Georgica*, p. 122. *Nonnii Dieteticon*. p. 49. The first edition, printed in 1627, says, the seeds of cauliflower were brought from Italy to Antwerp, where no seed was raised, or such only as produced degenerate plants.

² *Hist. Nat. Ægypti*, i. p. 157.

³ In *Horti Germaniæ*, at the end of *Cordi Opera*, p. 250. B.

⁴ *Histor. Planta.* ii. p. 829.

⁵ *Georgica Curiosa*, Nurnberg, 1716, fol. i. p. 643.

mark the several descriptive differences. However, this general observation should be noticed; it seems that the perfection to which this plant is brought in its several stages, is owing to the care employed in its cultivation. Further, there is scarce a doubt, but the sexual intercourse of these plants, according to the laws of vegetable life, can produce several new varieties,—in the seed of the plant. Much also depends upon the nature of the soil where implanted. For sandy soils, it appears, have the property of decreasing the odoriferous smell of plants; and it has been remarked, that they will not recover it when transplanted into a milder bed. Upon this experiment Rozier founded his proposition for improving rape oil.

The *brassica oleracea* has two very peculiar plants, participating of the nature of a cabbage and a turnip; the first is called turnip-cabbage, *kohlrabi* above the earth, (*brassica gongylodes*,) the stem of which swells out, above the earth, into a thick pulpy turnip-like tubercle, which is dressed and eaten like a turnip. It is a monstrous excrescence of the stem, which is hereditary, like the broad stem of the Italian fennel. There is certainly room to believe this species of cabbage was unknown to the ancients. Its mention, certainly occurs for the first time among the botanists of the sixteenth century. Spielmann conjectures it was brought from the Levant during the crusades; but it was known at too late a period to justify this persuasion.

That variety called *kohlrabi* under the earth, or turnip-rooted cabbage, the stem of which produces a similar kind of tubercle at the surface of the earth, or immediately under it. It has been thought by Beckmann, that this species was first described by Caspar Bauhin, in anno 1620, under the name *napo-brassica*, which it still retains, as a new species, to which he was not able to assign any synonyms.⁶ He says, that this turnip was cultivated on the Bohemian frontiers, where it was called *dorsen*, or *dorschen*; and the same name is given to it there at present, as we are assured from Mehler, who has given a good figure of it in his work.⁷ In Germany, it is commonly called *steckrübe*, and, as is said, was first made known in 1764, by the Bohemian glass-dealers.

The second species of cabbage is called by Linnæus *brassica napus*: this plant grows wild upon our sandy sea coasts, and also in the isle of Gothland: in many northern countries it is cultivated for the oil the seeds yield, sold

⁶ Prodromus Theatri, p. 54. Pinax, p. 111.

⁷ Mehler, p. 16. Tab. vi. (or 36). And in Kerner, Tab. 312.

under the name of the winter and summer *rape*. When thinly planted in a fertile soil, it produces esculent roots, having rather a harsh taste; its proper name in Germany is *steckrübe*. Such the old writers call it, and such is its present name in Bohemia, where it is cultivated; as such it is there termed *kohlrabi* under the earth. It appears, that in Germany, there are two species of this plant, called *steckrüben*, they are never very thick: the leaves arise immediately from the roots; but, it is said, in the *gongylodes* and *napo-brassica*, they proceed from the stem.

Our respectable authority (Beckmann) did not expect to find this species of rape cultivated among the ancients, they having no occasion for this species of oil, possessing plants and other substances, which yielded so much better, for similar purposes for which this is used, in the olive tree and the sesamum, with the seeds and nuts of the turpentine tree: the ancients obtaining their oils from these by expression, whilst the moderns procure theirs by distillation from the same materials. *Vide* his *Geopon.* lib. ix. 18, p. 611, and *Aristotelis Auscult. mirabil.* cap. 99, p. 183, where Beckmann has shown the difference of the two proceses. But to return. He conceived this species of turnip might have been produced in northern countries, since rape began to be cultivated for oil. Afterwards he thought this plant might probably have become so much domesticated among us, as to be found not unfrequently in a wild state. It might have been then remarked, by some who had made trial of it, that the pulpy roots of plants growing in a wild state, when become transplanted in a more congenial soil, were good for food and well tasted. When first cultivated, their flavour was doubtless remarked to be harsh; but by better and longer cultivation, they became much more tolerable to the taste, insomuch, that by degrees they were introduced to the tables of the great, under the names of *Markish*, *Teltow*, *Borsfeld*, *Bobenhäuser*, and *Wilhelmsburg* rapes. In each country they were named after those places where they acquired the best savour; which was the case whenever the soil consisted of a due admixture of loam and sand: he remarks, the more sand there was, the more preferable was the plant. From such districts large quantities of them were sent to great distances; but, perhaps, never in more abundance than from Teltow, in the Middle Mark; which small town, he says, sold to the amount of more than 2000 dollars, chiefly to Berlin and Hamburgh; from the latter place these agreeable roots were frequently sent to both Indies. They were also raised in considerable quantities in other districts,

but all procuring their seeds from Teltow. Adding, if we wish to cultivate them in our gardens, we must mix much sand with the soil, or procure fresh seeds annually.

The third species of cabbage, which the judicious Linnæus has enumerated, is the *brassica rapa*, the roots of which are more or less conical, differ in figure, colour, and taste. Our author here refers to Kerner's *Mayrübe*, tab. 553; of the *Guckelrube*, tab. 516; and Mehler's Tab. vii. (or 37.) That these roots are the same the Romans called *rapa*, and the Greeks γογγυλη or γογγυλις, appears subject to no doubt; although, at present, we may have greater varieties.

It appears to be a question, whether the Greeks and Romans were acquainted with our carrots; more difficulties appear to arise on this subject than could be expected. The necessary inquiries to elucidate this subject would occupy more room than we can spare; because the various opinions of the ancients, and the definitions of the botanists of the middle ages, would be found necessary.

It appears, that Theophrastus, as well as Dioscorides, among the Greeks, possessed the greatest share of botanical knowledge; these certainly were well acquainted with our carrot, to which they gave the name of σταφυλινος. Dioscorides says, in lib. iii. cap. 59, p. 198, that this plant, like dill, bears *umbellæ*, consisting of white flowers, which, in the middle, are of a purple red, or almost saffron red colour. That our carrots have these characteristics is well known. The plant meant by Dioscorides grew wild, but was reared in gardens, on account of its esculent root; our carrots also grew wild, previous to cultivation, although our Millar, the author of the *Gardener's Dictionary*, could not succeed in rendering the small pungent roots eatable by culture.

Columella and Pliny assert, that in Rome the *staphylinos* of the Greeks were known as *pastinaca*; although these authors afford little room for us to conclude that their *pastinaca* was our carrot. The former describes it as a plant useful to bees, while we know carrots, in either a wild or cultivated state, the little industrious insect is very fond of: he afterwards adds, that it was like *siser*. The Greeks had a synonym for this same root, terming it δαυκος, proved by Galen⁸ and Pliny.⁹ Dioscorides appears to make a distinction between those plants, he treating of them in different sections.¹⁰ He, however, acknowledges that both are

⁸ De Aliment. facult. lib. ii. cap. 67. clas. 4. p. 335, edit. of Basle; anno 1538, fol.

⁹ Plin. Hist. Nat. p. 168, and p. 377. ¹⁰ Dioscor. lib. iii. cap. 83, p. 207.

alike, having white umbellæ. Daucon may, therefore, be a peculiar kind of this genus.

Lastly, *pastinacæ*, or carrots, were also named *carotæ* by *Apicius*, lib. iii. cap. 21, p. 101, which last word is derived from *καρτον*, which, in *Athenæus*, denotes the large roots of this plant: also from *κερας*, which occurs in *Hesychius* and *Apuleius*, as a synonym of *pastinaca*, *staphylinus*, and *dau-cion*; but it may be possible that all these words have been corrupted by transcribers. From thence, however, the Germans as well as French have derived the appellation of *carottes*; the English have from thence their carrots. From the mode in which *Galen* described it, there can scarce remain a doubt but he meant our *caraway*, and which he termed *καρος*, and names it along with *staphylinus* and *daucus*. *Dioscorides* himself says, that the spices and aromatic seeds of the *καρος* were used, and that the roots also were boiled and eaten like carrots. Lib. iii. cap. 66, p. 200. *Pliny* calls the plant *careum*: from hence, and other instances, a doubt cannot exist that the Greeks as well as Romans, were well acquainted with our carrots; but it may be with probability conjectured, that they were far less used in cookery than they are at present: the ancients unquestionably used them for foddering their cattle; had they been as familiar to their tables as they are to ours, there is reason to believe mention of them would more frequently occur in their works.

Whether under the term *pastinaca*, the ancients did not sometimes understand our parsnip, though some may conceive it questionable, we think little doubt can be entertained. However, should this be questioned, a doubt cannot remain, but that this root is recognised by *Dioscorides* in the following description. He calls it *elaphoboscon*, describes it with *umbellæ*, that it had yellow flowers, and large sweet roots fit to be eaten. Lib. iii. cap. 80, p. 205. *Pliny* has also, as is usual with him, followed this author in his nomination; as it appears among all our umbelliferous plants, besides dill, fennel, and lovage, the parsnip appears the only one which has yellow flowers; at most, we know of no other which has yellow flowers, with esculent roots, and which so perfectly answers the above description. Should the parsnip have had no other names at Athens or Rome, it must have been very little used by the Greeks and Romans; for the only authors who have named them, which have been discovered, are the two above named. At present it affords an excellent fodder for cattle of several species, as well as furnishing an agreeable variety for the table.

Perhaps the wonder may cease, that it is so difficult to recognise those plants used by the moderns, among the works of the ancients, when it is considered that they all belong to one natural order, to discover the species exercises the skill of the most learned botanists. All the umbelliferous plants so nearly resemble each other in general appearance, that they may be readily confounded. This difficulty appears to have been increased by the old physicians, who used a great many plants of this kind, which they named after kitchen vegetables, and which they resembled in *general* appearance. So that from these causes, plants totally different in nature, are often found to occur under one name. To distinguish these correctly, it is found necessary to compare them with kitchen vegetables, and also among those used in medicine.

It is a well ascertained fact, that numerous kitchen vegetables, as well as many spices, were at first used only for medicinal virtues, but from these applications they were found to have agreeable tastes, whence they were cultivated for food, or to season dishes: of this kind, the *scorzonera* first became known in Spain about the middle of the sixteenth century, where it was originally used as an antidote to the poisonous bite of some snakes, which had wounded some peasants whilst mowing: this species of snake is called there *scurzo*.

A Moor had learnt its property in Africa, and he cured those persons so bitten with the juice of the leaves and the roots, but he was desirous to conceal the secret to himself. Some persons, however, followed him to the mountains, where he collected it, and discovered the nature of the plant; whence it was called *scurzonera*, or *scorzonera Hispanica*, and so named from the snake. It appears, that the person who first made it known was Petrus Cannizer, who transmitted it to John Odorich Melchior, physician to the Queen of Bohemia, with a drawing of it and a natural specimen: the latter sent what he had thus obtained to Matthioli, who, at that time, was unacquainted with it. Soon after, the roots were extolled in a particular tract written by Nicholas Monardes,¹¹ as a powerful remedy against the bite of snakes.

Probability is much in favour of the presumption that these roots were first used in Spain for food; that at about the commencement of the sixteenth century they were intro-

¹¹ A translation of this tract is found in *Clusii Exotica*, p. 15. The work itself was first given in Spanish, in 1569. See Bayle Diction. Histor. iii. p. 410.

duced as such into France, which, perhaps, afforded the anonymous author of a well-known work, intituled *Le Jardinier François*, an opportunity to observe that he was the first who had introduced those roots into French gardens. It should be noticed, that the author himself was a gardener, and practised that business in Paris, dealing in flowers, trees, plants, and seeds. See also Haller's *Biblioth. Bot.* i. p. 421, who describes its medicinal virtues; whilst *Lüder*, in *Küchergarten-briefe Dritter Theile*, speaks of its esculent properties.

The circulation of the above work, the French Gardener, greatly contributed to improve the practice of gardening in that country. At present, the roots of the *scorzonera* are to be found in most gardens; they are also occasionally prescribed by physicians, in the case of a *ptisan*; but, perhaps, the other kind, the *scorzonera humilis*, is preferred; though, it is said, in the apothecaries' shops, the Spanish, taken from the gardens, are used in its stead.

Among the species of the *allium* genus, shallots, in consequence of their milder taste, are preferred. A doubt cannot exist that this name, as well as the French *echalotte*, is derived from *Ascalonia*; and that the last above named species in the system, is called *allium ascalonium*, Kerner, tab. 307. Theophrastus, *Hist. Plant.* vii. 4. p. 761. ed. Heinsii, p. 138. Pliny, Columella, Apicius, Strabo, Stephanus, and a host of others, confirm this fact. Stephanus, indeed, asserts that the bulbs were observed in that neighbourhood. These names, we understand, are found in the oldest catalogues of the German garden vegetables. Caroli M. Capitulare de Villis, § 70, in *Brun's Beyträgen zu den Teutschen Rechten*. Helmst. 1799, 8vo. p. 40. There is also ample reason to conjecture, that our shallots were the *ascaloniæ* of the ancients, and that they came originally from Palestine, especially as Hasselquist found the same species growing there wild. Egypt also originally furnished great quantities of these vegetables. See the account of the expense of those consumed by the workmen, in erecting the great pyramid. *Herod.* An important doubt may be said, however, to arise from what Theophrastus and Pliny assert, namely, that the *ascalonia* could not be propagated by bulbs, but by seeds: on the other hand, our shallots, and those raised in Germany, and most likely in many other parts of Europe, never come to flower, and are obtained only by bulbs, so that Linnæus procured the first flowers, through Hasselquist, from Palestine. But why all others of the *allium*

species should not be propagated by planting bulbs, may be fairly asked.

Theophrastus, in his description, thus expresses himself: *cepe fissiles*, or *scissiles*, or *schistæ*, are leeks, which, when the leaves become yellow, are taken from the earth, and being freed from the leaves, are separated from each other, then dried, and in spring, are again put into the ground. If we believe that the *ascalonia* can be propagated only by seed, we must certainly read Theophrastus *μονα γὰρ οὐ σχίστα*, as Scaliger hath formerly observed.

KNIVES.

That knives were ancient, their necessity must inform us, being useful not only for culinary purposes and various domestic uses, but being also indispensable in sacrifices; a care which, in a very peculiar manner, engrossed the attention of the earliest of the human race. The first mention we find of this essential utensil, in the sacred record, appears upon this occasion; the incident alluded unto, is the sacrifice which the father of the faithful proposed to make of his only son. It occurs in the 6th verse of the 22d chapter of Genesis. “And Abraham took the wood of the burnt-offering, and laid it upon Isaac his son; and he took the fire in his hand, and a *knife*: and they went both of them together.” Although, it must be confessed, that the knives of those patriarchs must have been introduced much anterior to this; it is the first time we recollect the instrument being mentioned by name.

Rude, indeed, we may presume their instruments to have been; for as late as the heroic Grecian days, we perceive a dagger sometimes supplied their use: with this instrument, however, Agamemnon sheared the hair from the forehead of a lamb he was about to offer.

Ατρίδες δὲ ερουμάμενος χειρὶ μάχαιραν,
 Ἡοὶ παρ' ξίφους μέγα κυνλεοναίεν αορτο,
 Ἀρνῶν ἐκ κεφαλῶν ταμνε τειχας.

“Drawing his dagger, which was always put
 “Close by his sword, Atrides straightway cut,
 “Some hairs from off the lamb’s head.”

POTTER.

Which custom of using a dagger for a knife we have also seen was customary among the ancient Gauls, appearing from what is said in a preceding article on Forks; for which Dr. Potter cites the *Iliad* γ. and *Leipnosoph.* lib. xiv. The dagger, we may observe, was called by the Greeks *ἀκινάκες*,

which word they are conceived to have borrowed from the *Persians*, as we are informed by *Moscophulus*, in *vocibus Atticis*, *Pollux*, and others.

It may not be, perhaps, hazarding too much, should we say, that to us it appears probable this latter instrument obtained existence nearly as early as the former; taking into consideration the naturally hostile nature of our species, and their sanguinary appetites.

We had almost forgotten to notice, that the wife of Moses, the Hebrew historian, is said to have taken a sharp stone or flint, to supply the place of a knife in the sacrifice of circumcision; as he informs us, from the expression which she used upon this occasion. “Then Zipporah took
“a sharp stone, and cut off the foreskin of her son, and
“cast it at his feet, and said, Surely a bloody husband art
“thou to me.” *Exodus*, chap. iv. ver. 25. And, it is added, she said so, on account of the circumcision.

LIGHT-HOUSES.

A light-house, in marine architecture, is a building or watch-tower, erected on the sea-shore, to serve as a land-mark to mariners, on a low coast, by day, and in any situation to inform them of their approach to land in the night;—being of most essential utility to forewarn them to take soundings, avoid shoals, rocks, &c.: or else it is a building erected upon a rock in the sea, which, from its situation, would be extremely dangerous to vessels, were not some intimation given of the existence of a rock, where it is locally situated. Of this latter description is the celebrated *Eddystone* light-house, off Plymouth.

Although this species of architecture is not likely to have been so general in extreme antiquity, because it could not have been essentially necessary to any, except to those nations who, from the proximity of their situation to the coast, or other circumstances, pursued maritime concerns; or to those whose connexions rendered the encouragement of the marine of other nations important.

The oldest building of this description, which we believe to be upon record, is the famous *Pharos*, erected on the Egyptian coast, which being very low land, and exposed entirely to the almost constant west winds coming up the Mediterranean from the vast Atlantic, must have, of necessity, made the port of modern Alexandria, anciently called that of Damietta, or *Pelusium*, very dangerous. It was originally erected by

Ptolemy Philadelphus, for the encouragement and convenience of the Phœnician merchants, who constantly traded with Egypt, and who, according to *L'Abbé Pluche*, were the common factors of that empire; as the Egyptians possessed an unconquerable aversion to the sea, and, therefore, they never obtained its sovereignty: whilst the former people were the first who obtained the supremacy of that sea.

The island upon which Pharos stood, in the time of *Homer*, in his simple geography and estimation, was said to be one day's sail from the *Delta*; whereas, since the foundation of Alexandria, it was only a mile in distance, and was even joined to the main land by a mole, having a bridge at each end, or according to some authors, in the middle. This tower was, if report be true, justly entitled to the appellation it obtained, (being called *one of the seven wonders of the world*;) and it is reported, that the light from it has been seen at the distance of a hundred miles; which assuredly appears improbable, because the convexity of the earth, we think, would not permit it. Its height must have been, at least 2400 feet, or 800 yards from the base.

We are enabled to furnish the following particulars of this famous structure. It was built by order of that patron of learning and the arts, the very celebrated *Ptolemy Philadelphus*, by that eminent architect *Sostrates*, who constructed many of the public buildings in Alexandria. It is said to have cost Ptolemy *eight hundred talents*! Respecting its mode of construction, it was raised several stories one above another, each was decorated with columns, balustrades, and galleries of the finest marble and most exquisite workmanship; and some have said, that the architect had furnished the galleries, &c. with large mirrors, by which shipping might be seen at a considerable distance. However, respecting this edifice, once so famous, that its very name PHAROS was considered as a common term for all other constructions for the same purpose; it is now said, from Saracenic ignorance and brutality, aided, perhaps, by the assistance of the common leveller, time, that nothing now remains of this once elegant edifice, but an unsightly tower rising out of an heap of ruins, the whole being accommodated to the inequality of the ground on which it stands, and being, at present, no higher than that which it should command. Such as it is, there is now a light, we understand, usually maintained. There is also an island, which was called Pharos, in the Adriatic sea, on the coast of Illyria, which derived its name from Egyptian Pharos, above mentioned; as did also an island on the coast of Italy, opposite Bru-

usium, for the same reason: likewise the famous colossal statue of Apollo at Rhodes, answered the same purpose, and occasionally had the same appellation, as had a river of Asia, in the environs of Cilicia and the Euphrates. This last consideration brings us to the etymology of the word, as Ozanum says, “*Φαρος* originally signified a strait, as the Pharos of Messina.”

Of every description of modern *light-houses*, there is none more eminent than that called the *Eddystone*; with which description we shall close this article.

Mr. *Winstanley's* light-house was begun upon the Eddystone rock, in 1696, and was more than four years in building, from the numerous interruptions of the wind and the element he had to contend with, the violence whereof is truly alarming, occasioned by that rock being exposed to every wind which comes up the vast Atlantic, and that tumultuous sea, the Bay of Biscay. Which obstacles were considerably increased by the form of the rock itself, having a regular slope to S.W. and from the very deep sea in its vicinity, it therefore receives the uncontroled fury of those seas: meeting with no other object whereon to break their vehement force, the effect is so great at high water with a S.W. wind, which continues for many days, though a calm may have succeeded, the violent action of the waters has not ceased, but break frightfully on Eddystone. An engraved plate of Mr. Winstanley's light-house was circulated at the period of its erection, from which, it appears to have been a stone tower of twelve sides, rising 44 feet above the highest point of the rock, which, in the dimensions on which it was built, 24 feet in diameter, was 10 feet lower one side than it was upon the other; at the top was a balustrade and platform: upon this were erected eight pillars, which supported a dome of the same diameter as the tower; from the top of which arose an octagon tower, of a diameter of 15 feet and 7 in height. On the summit was placed the lantern, 10 feet in diameter and 12 in height: it had a gallery surrounding it to give access to the windows. The whole was surrounded by fanciful iron work. The entry was by a solid stone door at the bottom; the whole building was of the same material, except the aperture for the staircase. At the bottom was a room 12 feet high, for a store-room; the next story was of the same height, which was the state room; and the third was of a similar height, which was a kitchen. Those compartments occupied the extreme height to the platform. The dome above this, contained the lodging-room; the octagon above it, the look-out.

The reason why it occupied so much time in building, was

because the men could work only in the summer months. The first summer was occupied in making holes in the rock, and fastening irons to hold the future work. The second year was spent in erecting a solid pillar, of 14 feet diameter and 112 feet high, for the future support of the building. The third year this was augmented in diameter and increased in height. This building was eventually finished, within the time above mentioned, at an immense expense. It stood the opposition of the elements. The violence of the sea was so great, that Mr. Winstanley said it has been seen to rise upwards of 100 feet above the vane, whilst the sides of the building were covered with surf as with a sheet, so that the whole house and lantern were occasionally under water. This edifice withstood the conflict of elements till 1703, when the architect being at Plymouth, was desirous of visiting it, for the purpose of inspecting some repairs, went to it, but returned no more; for a storm arose, which left not a relic of it standing, except the iron-work which had been fixed in the rock. The Corporation of the Trinity had then to erect another, for which purpose they employed a Mr. John Rudyard; who was a silk-mercator on Ludgate-hill. Mr. Rudyard's genius was said to have qualified him well for the undertaking. It appears, that he erected a house made chiefly of wood, which bore many traits of his genius. It was a conical frustrum, 156 feet diameter at the base; its altitude 62 feet. At the top of the building was a balcony railed round; in the centre of its area was the lantern. This building was made quite plain, excepting the well for the staircase which was solid for 32 feet. In the centre a strong mast was erected. The building was admirably fixed to the rock, from the very peculiar manner of making the holes to hold iron cramps, they being made for the internal cavity to diverge on each side, by an extreme of one inch at the depth of sixteen inches. The cavity was first filled with tallow; the hot iron then dipped in the same substance, put into the rock, and eventually filled with pewter, which displaced the tallow, being heavier, the grease serving to protect the iron from the corrosive acidity of the salt water. In 1708 it was finished, so far as to receive a temporary light. It stood for forty-four years, and showed that it was only liable to destruction from the very perishable nature of its materials. However, on the 2d December, 1755, the upper part of it took fire, burnt downwards to its entire consumption. The concern had been leased to a Captain Lovell; but at the late period his possessions had been distributed among a number of people, when the care of rebuilding it was intrusted to Mr. Robert Weston, to whom

Mr. John Smeaton was recommended by the President of the Royal Society, who appears to have been well qualified for the undertaking. He accordingly furnished a plan for, and superintended the building which now stands. Mr. Smeaton's conception was quite different to that of the last projector: he conceived that nothing could withstand the action of the wind and water so well, and, at the same time, prevent all accidents like the last, as could a building whose gravity should secure its most sure protection. He accordingly constructed his of the most massy stones, all dovetailed into each other, formed of Cornish moor and Portland stone; all the joints breach each other, as the masons term it, or on each joint occurs the central stone of the next course. There are fourteen courses of these stones first laid in this manner, of a great thickness each course. On the 12th June, 1757, the first stone was laid in its place, each stone being pierced when it was laid, a strong trenail, or oak pin, was driven through to pin it fast to its place: the dovetails not fitting so close to each other, because it was necessary to leave some space for the cement, this pin was calculated to secure the stone till this could be applied and had fixed; the cement used was composed of Watchet lime and *puzzolana*, or Dutch terras, being made at the moment by mixing up in a pail with water; this mixture was poured upon the work and ran into every cavity and crevice; this, however, was not sometimes exempt from the injury of the sea; whenever it was injured, the defect was supplied by having some oakum, cut fine, and mixed with this cement, introduced into the joints; then they were secured with a coat of plaister of Paris, *pro tempore*, and this was never known to fail, if the work stood for one tide. In this manner the platform was erected, all of the most solid materials and substantial workmanship. On the 30th of September, 1758, the work having been continued from the 11th of the preceding May, had arrived at the store-room floor,—here an iron chain was let into the stone, as follows: the recess being made, and the chain well oiled before insertion, the groove which received it was divided into four separate dams by clay; two kettles were used, to hold a sufficiency of fused lead, 11 cwt.: whilst the lead was in a state of fusion, two men with ladles filled one quarter of the groove; as soon as it was set, they removed one of the clay dams, and then filled the next quarter, pouring the liquid lead on the middle of the first quarter, till it melted together into the second; the dam at the opposite end was now filled, and then the fourth, by this means the lead was associated into one solid mass. The centring for the floor was next set up,

the outward stones being first set, and then the inner ones. Thus the base floor was finished. The men could work no longer than till the 7th of October that year. The winter was spent in preparing the iron, copper, and glass-work for the lantern; and the spring in unsuccessful endeavours to recover the moorings for the vessel which attended the work, for the occasional retreat of the men employed. On the 5th of July, the work was resumed: the stones for building had been hitherto raised from the boats, by what are called *shears*, formed of two poles, with the lowermost ends extended to a sufficient width, whilst the upper ends met in a point; here was fastened tackle, pulleys, &c. to raise them to a sufficient height to be swung over the building; this course was now, of necessity, altered; a block, with pulleys, being suspended from the top, projected to a sufficient distance, supported by beams. After the base had been formed as described, a different mode of operation was necessary to complete the superstructure, the work being now advanced so high as to be out of the constant wash of the element; instead of grooves being made to fasten the stones together, they were fixed by means of iron clamps and lead. The stones to complete the superstructure were landed, and first drawn up by machinery, called a *jack*, through the well in the interior of the building, being a cavity for the staircase. The work proceeded now more rapidly, so that by the 26th of August, the stairs and all the masonry were finished: the iron frame for the lantern next screwed together in its place, the lantern soon completed. It should have been noticed, that after the first entry was closed, the shears were supported by a tackle, called a *guy*, attached to the top of the shears, and hooked so far on the outside of the building, the stone being drawn up by a windlass, the *guy* was drawn in to swing the stone over the building. The balcony rails and stone basement for the lantern having been completed, on the 17th of September the cupola was set up by a particular kind of shears constructed purposely, the *guy* in different places being fastened to booms projecting from the several windows of the upper rooms; the next day the ball, double gilt, was screwed on, and on the 11th of October, an electrical conductor was fixed, which finished the edifice. A light was then exhibited, which has continued ever since. An ably constructed cornice throws the spray from off the building, that it is often seen at Plymouth with the appearance of a white sheet, throwing itself to double the height of the building, which from low water mark to the apex of the ball is 100 feet.

We have been thus minute in this description, because

this *pharos* is considered to be the best constructed of all modern known edifices for like purposes. There are in numerous places on our coast, a variety of light-houses, as well as *Martella* towers.

LIGHTING OF STREETS.

The Jews kept the streets lighted on the eve of their great festival, called *festum encœniorum*, the feast of the dedication, which, according to general belief, occurred in December, and continued for eight days, having a number of lamps lighted before their houses.¹ A passage in *Æschylus* informs us that similar illuminations were used also in Greece. At Rome, the forum was lighted when games were celebrated in the night-time. *Caligula*, also, upon a similar occasion, caused the whole city to be lighted; as we are told by *Suetonius*, in *Vita Caligula*. *Plutarch*, also, in *Vita Cicero*, informs us, that upon that advocate returning home late at night, after he had defeated the conspiracy of *Catiline*, lamps and torches were lighted in all the streets, in honour of that great orator. The Emperor *Constantine*, caused the whole city of Constantinople to be illuminated with lamps and wax candles on Easter eve.² The early fathers of the church, in the first century, were often in the habit of upbraiding the Christians for lighting and illuminating their houses, on idolatrous festivals, in a more elegant manner than the idolaters did themselves;³ this they considered as a species of idolatry. It was usual on birth-days, among the ancients, to suspend lamps from chains.⁴ The streets, not only of Antioch, but of Edessa, in Syria, were lighted in the fourth and fifth centuries; to prove which, a passage occurs in the history of *Jesue Stylites*, where it is explicitly said, that *Eulogius*, governor of *Edessa*, about the year 505, ordered lamps to be kept burning in the streets during the night; and that he employed upon that occasion, the oil which was before given to churches and monasteries.

In the beginning of the fourth century, *Libanius*, writing a panegyric in praise of his native city, *Antioch*, says,

¹ Et accedere mos est in eis lumina tempore vespertino, ad ostium domorum. Gemara Babylonica, ad tit. *Sabbath*. c. ii. p. 21.

² Euseb. Pamphili. lib. iv. de Vita Constantini, cap. 22. Cant. 1720. fol. p. 637. Compare the passages there found with Greg. Nazianzeni Orat. 19, and Orat. 2. p. 676, where the author alludes to the festival of Easter.

³ Tertullian. de Idololatria, cap. xv. p. 523

⁴ J. Lipsii Electa, lib. ii. cap. 3.

“The light of the sun is succeeded by other lights, which are far superior to the lamps lighted by the Egyptians, on the festival of Minerva of *Sais*. The night with us differs from the day only in the appearance of the light; with regard to labour and employment, every thing goes on well. Some work continually; but others laugh and amuse themselves with singing.” He certainly here must allude to lighting the streets.

In another passage, in the oration to *Ellebichus*, the same author tells us, that the ropes from which the lamps that ornamented the city were suspended, had been cut by some riotous soldiers, not far from a bath. “Proceeding,” says he, “to a bath, not far off, they cut with their swords the ropes from which were suspended the lamps that afforded light in the night-time, to show that the ornaments of the city ought to give way to them.” Moreover, also at *Antioch*, the following passage of *St. Jerome*, appears to confirm the previous belief, from the quotations which have been given, where he thus expresseth himself: “In an altercation between a *Luciferan* and an *Orthodox*, an adherent of the schismatic *Lucifer* disputed in the street with a true believer, till the streets were lighted, when the listening crowd departed; and they then spat in each other’s face and retired.” *Dominicus Vallarsius*, in his elegant edition of the works of that father, has proved, in a short dissertation, that this indecent dispute took place in the year 378.

Basilus the Great, in a letter to *Martinianus*, giving an account of the miserable situation of his native city *Cæsarea*, in *Cappadocia*, anno 371, says, “They had nights without lights,” (*noctes non illustratas*.) The inference which this admits is, that *he knew* this was not the case in *some other cities*, and probably, that he had lived in some other town with superior accommodations.

Notwithstanding all we have seen, it really does not appear that there were either in the cities of Athens or of Rome, any general regulations of the police with respect to the regular illumination of those cities; but on the contrary, it appears, they were never thus lighted, except, indeed, upon some very particular occasion. The general illumination of the streets is, we believe quite modern, and an European invention; M. St. Evremond says, the illumination of the streets of Paris, during the night, by a multitude of lamps, deserves that the most distant nations should go to see what neither the Greeks nor Romans ever thought of for the police of their republics. This opinion is said to be well founded: for, although both Athens and Rome might

have been lighted upon some peculiar occasions; yet that it was a constant or universal practice in those cities, cannot by any means be proved. This, therefore, being the case, to the best of the information we can procure, we must come to nearer times, and have recourse to that place where we are likely to find it.

Maitland says, in his *History of London*, that as early as 1414, an order was issued for hanging out lanterns in the night, to light the streets; for this assertion that writer refers to *Stow's Survey of London*, published in 1633, where it is expressly stated, that in 1417, "Major Sir Henry Barton, skinner, ordained lanthorns with lights, to bee hanged out on the winter evenings, betwixt Hallontide and Candlemasse." Also in the year 1668, when regulations were made for improving the streets of the metropolis, the Londoners were reminded that they should hang out lanterns duly at the accustomed time. In the year 1690, this order was renewed, and every housekeeper was required to bring out a light or lamp, every night, between Michaelmas and Lady-day, and to keep it burning till the hour of twelve at night. In the year 1716, it was ordered by an act of common council, that all house-keepers, whose houses fronted any street, lane, or public passage, should, in every dark night, that is, every night between the second night after every full moon till the seventh night after every new moon, set or hang out one or more lights, with sufficient cotton wicks, that should continue to burn from six o'clock at night till eleven o'clock of the same night, under the penalty of one shilling. All these regulations, however, seem to have been ineffectual, from bad management or neglect.

Eventually the city was lighted by contract, and the contractors were obliged to pay annually to the city £600; and they only received six shillings per annum of every house-keeper whose rent exceeded £10; all house-keepers who brought out a lamp or candle themselves, were exempt from paying towards the public lamps.

The streets were lighted no more than 117 nights; and as this furnished opportunities to thieves and robbers to commit depredations in the night-time, the Lord Mayor and Common Council judged it proper in the year 1736, to apply to parliament for power to enable them to light the streets of the city in a better manner. In consequence, an act was passed by which they were empowered to erect a sufficient number of glass lamps as they should judge proper, and to keep them burning from the setting to the

rising of the sun, throughout the year ;⁵ instead therefore of 1000 lamps, the number was increased to 4679 ; but as these were insufficient, several of the wards made a considerable augmentation, so that the whole could amount to no less than 5000.

These, however, were not the whole amount of all the lamps in London, but of that district properly within the city and its liberties. As this division, even at that time, formed only about one fifth part of London, Maitland reckoned the whole number of public and private lamps to have been, at the period he wrote, upwards of 15,000. The time of lighting, which had been only 750 hours annually, was increased to 5000. Since which period, various acts have been passed by the legislature for regulating the lighting, watching, and cleansing the streets of this metropolis ; forming different courts of sewers, lighting, watching, &c. so that now, at this period, in 1819, we should presume, no city in Europe is more clean, wholesome, and better regulated.

With respect to lighting, various improvements have been made from time to time in the construction of our lamps ; that article of necessary police having invited the attention of the philosophic, patriotic and ingenious : and none, we humbly conceive, has a higher claim upon the gratitude of posterity than has that learned and patriotic nobleman the Earl of *Dundonald* ; a gentleman whose life and ample fortune has been spent in scientific improvements for the advancement of the commercial and agricultural interests of his country. But it is believed that he, alas ! at this period experiences the fate of those rare public spirited beings who have made such ample sacrifices for the good of others, to the neglect of his own private and individual interest. Such rare instances of disinterested patriotism, surely have an equitable claim upon the gratitude of an enlightened people. But so did Middleton languish ;—so did Hampden bleed ;—so have an infinite number in ancient and modern times suffered, and instead of meeting with a return of gratitude from their country, every ignominy and every injury have been heaped upon their meritorious heads. But of all the improvements which the art of nocturnal illumination has experienced, there is none can equal the truly scientific speculations of a learned gentleman of the medical profession, whom we have the honour to regard as

⁵ Maitland, i. p. 566.

our friend,—the learned *Dr. Thornton*, who first conceived the happy idea of applying *hydro-carbonic gas* for the purpose of illumination. This pure, this brilliant light, which now deceives the conscious sun, and adds new blushes to *Aurora's* cheeks, is assuredly the happiest invention of the philosophic mind. Its superiority stands confessed by every order of men,—except those, indeed, who are determined to believe that nothing *new* can be good ;—but their opinions in such cases are not of much account.

The world may form an opinion of the decided preference due to the application of gas, who have not yet witnessed it, on being informed that the superior light which this affords, is, that one gas lamp will supply the place of from six to ten lamps of the old construction, and with a brilliancy vastly superior ; as is proved by the number of old lamps recently removed from various streets in the city and in the west end of the town, for the reception of the new invention.

There are established three gas companies in this metropolis, for the purpose of supplying its various parts with gas ; most of the great public streets in the city of London, and about the imperial residence at *St. James's*, and also the vicinity of the Parliament house ; all public official stations, and the theatres, are lighted therewith already ; preparations are making for lighting the parish of *St. Pancras*, and it will soon become general.

The public enjoys the benefit, and the gas companies will, doubtless, reap the profit,—whilst the learned and ingenious author of those blessings enjoys the consciousness of seeing the perfection of his designs :—and we believe that is all. *Oh tempora ! Oh mores !* *Regulus* lived, he died for the good of his country,—but he enjoyed its gratitude :—'twas all, perhaps, he wished :—'twas all they could bestow upon the individual. *Dr. Thornton* lives,—and we can say, still lives in the exercise of the plenitude of all those distinguished acts which his peculiar skill in the new practice of applying the powerful aid of the factitious gases in medical cases, and a benevolent heart in aid of the afflicted can inspire.

Among modern cities, if London be excepted, Paris appears among the earliest which observed the necessary regulation of the police in lighting the streets. It appears, that in a very early period, that city was infested by street robbers, and other incendiaries, the inhabitants of which were, from time to time, ordered to keep lights burning after nine in the evening, before the windows of their respective houses which fronted the street. This order was

issued in the year 1524, and renewed in 1526, and again in 1553; but in the month of October, 1558, *fallots* were directed to be set up at the corners of the streets, or where the street was so long that it could not be lighted by one, three were erected in different parts of it. These lights consisted of a vase filled with pitch, resin, and other combustibles, which had been usually employed in the king's palace, and to light the courts of princes. In the month of November, in the same year, these lights were changed for lanterns, somewhat similar to those now used. The lighting the Parisian streets continued imperfect for a long time, till the Abbé Laudati, an Italian of the Caraffa family, conceived the idea of letting out torches and lanterns for hire. In the month of March, 1662, he obtained an exclusive privilege to this establishment for twenty years; and he undertook to erect, at certain distances, not only in Paris, but also in other cities of the kingdom, booths or posts where any person might hire a link or lantern, or, on paying a certain sum, be attended through the streets by a man bearing a light. He was authorised to receive from every one who hired a lantern to a coach, five sous, for a quarter of an hour; and for every foot-passenger three sous. To prevent all disputes in regard to time, it was ordered that a regulated hour-glass should be carried along with each lantern.

In anno 1667, regulations began to be put on a footing for illuminating the French capital; from which time the police, which has since regulated that metropolis, was improved in both those excellent regulations, watching and lighting; most other cities, and even boroughs, in Europe, have, in some degree, imitated the improvements there made. From thence, affairs of judicature and those respecting the public police, instead of being committed, as before, to one magistrate, called the *Lieutenant civil du prevost de Paris*, were by a royal edict, bearing date in the month of March, in the above year, divided between two persons; one of whom, retained the management of judicial affairs, and also retained the old title; and the other, who had the cognizance of affairs of police, was denominated *Lieutenant du prevost de Paris pour la police*, or *Lieutenant général de police*. The first lieutenant of police was Nicholas de Reynie, a man who, according to the praises bestowed on him by French writers, formed an epoch in the history of modern police. In the history of the famous city of Paris, the historian calls him an enlightened, upright and vigilant magistrate, as zealous for the service of the king, as for the good of the people, and who succeeded

so well in this new office, that we may say, adds the author, it is to him, more than to any other, that we are indebted for the good order which prevails at present in Paris.

The first successful regulation by which *La Reynie* rendered a service to the police, was that of improving the (*guet*) night watch, and the lighting of the streets.⁶ These regulations do not appear to have been made immediately, but some years after his appointment, *i. e.* on the 23d of May, 1671, an order was made that the lanterns every year should be lighted from the 20th of October, till the end of March, in the year following; and even during moon-light, because the latter was of but little use in bad weather; and even in fine weather it was not sufficient to light some of the most dangerous streets.

Before this period, the streets were lighted only during the four winter months; and on account of the numberless atrocities committed in the night, when there were no lights, the Parisians offered to contribute as much money as would be sufficient to defray the expenses of keeping lights throughout the whole winter.

The lamps employed by *La Reynie*, were, on account of their likeness to a bucket, called *lanternes à seau*, which succeeded those previously used and invented by one *Herault*, called *lanternes à cul-de-lampe*.

When De Sartines held the office of *Lieutenant de police*, a premium was offered to whoever should discover the most advantageous means of improving the lighting of the streets; and the Academy of Sciences were to decide on the different plans which might be proposed. In consequence of this offer, a journeyman glazier, named *Goujon*, received a premium of 200 livres, and Messrs. *Bailly*, *Le Roy*, and *Bourgeois de Chateaublanc* 2000 livres. To the last mentioned gentleman is ascribed the invention of the present reverberating lamps, described by *La Vieil*, which were introduced in 1766.

A satirical publication, called *An Essay on Lanterns*, written to ridicule antiquarian researches, and certain eminent Parisians, contains some authentic information respecting lighting the streets. The author says, "We are told that several reverberating lamps were invented by an Abbé P. who, therefore, is the second abbé who can boast of having illuminated the first city in the world."

⁶ See Code de la Police, par M. D., troisième edit. Paris, 1761.

In 1721, the lamps in the French capital are said to have amounted to 5772; however, in the *Tableau de Paris*, they amounted in 1760 to only 5694, and in the *Curiosités de Paris*, in 1771, to 6232.

In 1771, the road between Paris and Versailles, which is about nine miles in length, was lighted at an annual expense of 15,000 livres, by the same contractors who lighted Paris. The city of Nantes was lighted in the same year.

We are informed by Beckmann, that in the cities of Lower Saxony, the streets of which are said not to be so dark as those of London, the lighting continues 1519 hours. The same authority assures us, that the streets of *Amsterdam* were lighted as early as 1669. At the *Hague*, an order was made in 1553 for the inhabitants to place lights before their doors during *dark* nights; afterwards small stone buildings were erected at the corners of the principal streets in which lights were kept burning; however, in 1678, lamps were fixed up in all the streets.

Copenhagen was first lighted in 1681; regulations have since been made, by which it is much improved, and a night-watch established.

The streets of *Rome* are not yet lighted. Sixtus V. was desirous to introduce this improvement, but he met with insurmountable obstacles. However, in order to obviate that as much as possible, he ordered an additional number of lamps to be placed before the images of the saints. *De la Lande* says, in his travels, that *Venice* had been lighted for some years before the period when he wrote, by 3000 lamps. *Messina*, and *Palermo*, in Sicily, are both lighted.

Madrid is also lighted, as are *Valentia* and *Barcelona*. *Lisbon* has no lights.

In 1672, *Hamburgh* was proposed to be lighted in the following year; the proposition was acceded to. Some say it was first lighted in 1675.

In the year 1679, *Berlin* was lighted; but more effectually in 1682, by order of the elector, *Frederic William*. *Potsdam* has 590 lamps.

The capital of Germany was begun to be lighted as early as 1687. The lights were hung out in the evening on a signal given by the *fire-bell*. In 1704, lamps were introduced. In 1776, the lamps, which had been in number 2000, were increased to 3000. In 1783, the annual expense of lighting that city amounted to 17,000 florins.

Leipzig, the capital of Saxony, was lighted in 1702, and *Dresden*, in 1705. In 1766, the number of lamps at

the latter place amounted to 728, which were lighted with *rape* oil.

In the landgravine of *Cassel*, the landgrave *Charles*, in 1721, introduced the practice of lighting; which, however, was afterwards dropped, but revived in 1748; and in 1778, the number of lamps amounted to 1013. *Hanover* experienced the blessing of light by night in 1696. *Halle*, in Saxony, in 1728; *Gottingen*, in 1735; *Brunswick*, in 1765; and *Zurich*, in 1778. *Philadelphia*, in America, is also lighted; and has the extra convenience of a foot pavement, which an infinite variety of European cities still want.

LOGARITHMS.

Logarithms is the name of a species of mathematical calculation, and chiefly applicable to trigonometrical purposes; which, if not invented, were greatly improved, and the use and application of them extended by *John Napier*, Baron of *Merchiston*, in Scotland, who first published his *Logarithmic Tables* in 1614. This intelligent gentleman first described satisfactorily the scientific nature of logarithms; his celebrated work was translated by Mr. *Edward Wright*, and published by his son, in conjunction with Mr. Professor Briggs, in 1616, or 1618.

Definition.—The term *Logarithm* is a compound of two Greek nouns, *λογος* *ratio*, and *αριθμος* *number*; hence it is to be defined the *ratio of numbers*,—the indices of the ratio of numbers one to another; or a series of artificial numbers, proceeding in arithmetical proportion, and corresponding to as many others, proceeding in geometrical progression, ingeniously contrived for the ease and expedition of calculation.

This mode of mathematical proportion has been described differently by various authors; some have termed it *numerosum proportionatum æqui-differentes comites*. With this definition, Drs. *Halley* and *Stifelius* were unsatisfied, and they thought its specific nature and general qualities would be better expressed by thus defining them: accordingly, they say, they should rather be called *the indices or exponents of the ratios of numbers*; and under this appellation we believe they are now regarded.

Lord Napier's method of constructing his table, was concealed until the author had first obtained the sense of the learned and scientific upon his invention. Never-

theless, *Kepler*, the great astronomical and philosophical precursor of *Newton*, published his *Chilias Logarithmorum ad totidiam numeros rotundas*, at Marpurg, in 1724.

Spidell, in his *New Logarithms*, published in 1619, and soon reprinted with considerable additions, and a sixth impression in 1624; *Benjamin Ursinius*, in his *Table of Logarithms*, printed at *Cologne*, in 1625, with others in England, and other parts of Europe, laboured at the computation of logarithms, and constructed various small tables, agreeable to the designs of Baron *Merchiston*: however, of all these, Professor *Briggs* was the most successful; he so much improved upon the learned Baron's idea,—an idea, we are told, he had himself entertained twenty years previous to his having heard of *Napier's* design,—that it is now upon his system most logarithmic tables are constructed.

In the present state of our knowledge upon this subject, we can perceive the many easy methods which may now be employed for this purpose, at the time the labour of early writers, to effect similar productions may be appreciated. The toils of the first computations were exceedingly great, some idea of which may be collected from the following illustration of *Briggs's* method, who has given this rule: *To find the logarithms of any number according to his method.* 1st. Because 1, 10, 100, 1000, 10,000, &c. constitute a geometrical progression, their logarithms may be taken at pleasure; but to be able then to express the logarithms of the intermediate numbers by decimal fractions: take 0.00000000, 1.00000000, 2.00000000, 3.00000000, 4.00000000, &c. 2dly. It is manifest, that for those numbers which cannot be contained in this scale of geometrical progression, the just logarithms cannot be had; yet they may be had so near the truth, that as to matters of utility, they shall be altogether just. To render this apparent, suppose the logarithm of 9 be required, between 1.00000000 and 10.00000000, find a mean proportional, and between their logarithms 0.00000000 and 1.00000000, an equi-different mean will be the logarithm thereof, that is, of a number exceeding 3 by $\frac{622777}{100000000}$; which is therefore far remote from 9. Between 3 and 10, therefore, find some other mean proportional which may come somewhat nearer 9; and between 10 and this mean, another still; and so on between the number next greater and next less than 9, till you arrive at 9 $\frac{1}{100000000}$; which, without any sensible error, may be taken for 9 itself. Seeking then, in such case, for the logarithms of the mean proportionals, you will have

0.954251, which is exceedingly near the true logarithm of 9. 3dly. If in like manner you find mean proportionals between 1.00000000 and 3.1622777, and assign the proper logarithms to each; you will, at length, have the logarithm of the number 2, and so of the rest.

The preceding was the method employed by the early calculators of logarithms; and although they had in particular cases certain means of abridging the operation, yet it is evident that the computations were not effected without immense labour. An interesting and definite account of which, with an explanation of the several degrees of modification of the above method made use of by different authors, may be seen in *Dr. Hutton's Mathematical Tables*.

It may be unnecessary to observe, that these computations were only required for prime numbers; but these being once obtained, the logarithms of all other numbers were procured by simple addition.

Having only spoken of logarithms as applicable to numerical computation: they are of infinitely more extensive use in the higher branches of geometry, and particularly in trigonometry; in the doctrine of fluxions, of which the very eminent *Mac Laurin*, in his *Treatise on Fluxions*, published in answer to *Bishop Berkeley's Charge against Mathematicians*, has rendered a most satisfactory account, who proceeded upon the doctrine of *Napier*, as delivered in his *Mirif. Logar. Canon. Descript.* He there supposes logarithms, and the quantities to which they correspond, to be generated by the motion of a point. If this point moves over equal spaces in equal times, the line described by it increaseth equally.

Again, a line decreases proportionally when the point which moves over it describes such parts in equal times as are always in the same constant *ratio* to the lines from which they are subducted, or to the distances of that point at the beginning of those times from a given term in the line. In the like manner, a line may increase proportionally, if in equal time the moving point describes spaces proportional to its distances from a certain term at the beginning of each line. Conceiving this mode to be applicable to the solution of questions in spherical trigonometry, for the sake of illustration we will give a diagram of the solar system,¹ and suppose the point S to represent the sun, and the other astronomical characters to stand for the other planets. Here the orbit of *Mercury* (☿) is removed from the mean

¹ See Frontispiece.

solar presence 36,841,468 miles; admitting he performs his revolution in 87 days 23 hours, in what time will *Venus* (♀) perform hers, whose orbit is removed 32,050,018 miles farther distant from the centre of the system; in what time will she perform her orbicular revolution? In 224 days 17 hours.

The orbicular track of the *Earth* (♁) is removed from that of ♀ 26,281,514 miles, performing her annual course in 365 days, 5 hours, and 49 minutes.

The orbit of *Mars* (♂) being removed from that of the ☉ 40,841,148 miles, and performs his course in 1 year, 321 days, 17 hours. So the orbit of *Jupiter* (♃) is beyond that of the last planet 49,976,528 miles, and he accomplishes his orbicular course in 11 years, 314 days, 18 hours.

The orbit of *Saturn* (♄) is placed beyond that of the last planet 349,976,768 miles, and he performs his annual course in 22 years, 167 days, 6 hours.

Beyond these rules afforded by arithmetical proportion, in discovering the *mean* between mathematical proportion and geometrical progression, in solving questions like the preceding, Baron Merchiston's original idea first had existence. Since whose time, logarithms have been brought to so great a degree of perfection by subsequent mathematicians, that they are found most peculiarly useful in algebraic solutions, discovering the mean proportionals between time and distance, and in whatever use a medium is required; besides, they will be found peculiarly useful in all geometrical and trigonometrical purposes, sines, tangents, navigation, land-surveying, &c. and thus rendering speculative science subservient to the most useful purposes, the true end of all philosophical investigation.

Among the many works which have been written upon the subject of logarithms, appear the following: Briggs's Canon of Logarithms for natural Numbers, from 1 to 20,000, and from 90,000 to 100,000, constructed and published, in conjunction with and by the approbation of the Baron Napier. Briggs also published a second and improved book on the subject, in 1631.

MADDER.

This useful plant, being one among the many which are found of considerable importance to the manufacturers of our own country, which will account for its introduction, is found answerable to the descriptions of Dioscorides, Marcellus Virgil, Theophrastus, Pliny, and other naturalists, and is thus described by a contemporary writer, Beckmann. This plant,

the root of which is either dried and bruised, or else used green, has a weak, square, jointed stem; if conducted by any rod, will rise to the height of several feet: but as it is in many soils indigenous and grows wild, it crawls along the ground. At each joint there are five or six leaves, about three inches long, almost an inch broad in the middle, and pointed at both ends. The upper side of the leaf is smooth; but the middle fibre of the under side is armed with rough adhesive hairs, or prickles; and some of the same kind may be found upon the stem. On this account, the leaves, which drop annually, adhere readily to other bodies, like the *asperugo*. The branches, which, in June, bear flowers divided into four yellow leaves, proceed from the joints. The fruit, a kind of berry, which, towards the time of its ripening, is first of a brownish colour, then a black, yields a round seed. The roots are sometimes of the thickness of one's finger, grow deep in the earth, are surrounded by many small fibres, have a yellow pith, covered with black bark or rind. This plant grows wild in the Levant, Siberia, Tartary, Italy, several parts of France, England, and Switzerland. The cultivated kind is well known in many countries, where it is propagated to considerable advantage.

Von Strahlenberg says, this plant, which in the German tongue is called *grapp*, grows plentifully in *Russia*, where it is as good as that cultivated in gardens in Germany. It is used by dyers to dye such a red as is used for soldiers' clothes. There also grows in *Siberia*, on the banks of the *Narim*, a herb or root they call *marana trava*, which likewise gives a red colour, but will not bear with alum. Besides this, near the city of *Crasnoyahr*, and in other places, a root is found, which gives a reddish tincture. The Tartars call it *bada tussu*; and the common people tincture their tea-water with it, or use it frequently alone for that herb. But it is somewhat astringent. Near the city of *Tobolskoi*, grows a herb, which the Tartars call *kna*, with which their women colour their nails red; it is believed to be the same with the bastard *henna*, found in *Persia*.

The description of *Dioscorides*, when compared with the preceding of Beckmann, is discovered to agree well with it. He calls it *ereuthodanon*; his description will be found to be a counterpart of the foregoing, in its most material points. He even compares "its long square stem, armed with many hooks," to that of *asperugo*; and he tells us, that the leaves stand in the form of a star round the joints. The fruit was at first green, then red, and lastly black. "The thin long roots," he adds, "serve for dyeing; and, on that account, the

cultivated kind (it must have been cultivated in his day) is reared with much benefit in Galilea, around Ravenna in Italy, and in Caria, where it is planted either among olive trees, or in fields destined for that purpose." In some MSS. it is remarked, the Roman name for this plant, as *Marcellus Virgil* observes, meant the same thing as *rubia sativa*; and that it was called in *Hetruria lappa minor*, perhaps because of its adhesion to other bodies: on account of its dye, it was also called *cinnabaris*. It is remarked, that the name *sandyx*, which *Virgil* gives it, in *Eclogue iv.* 45, where he speaks of sheep which had eaten it, applies to the presumed effect upon the wool.

Sponte sua sandyx pascentes vestiet agnos.

Spontaneously the wool invites the ruddy tint,
And sanguine food prevents the dyer's toil. J. F. L. W.

Hence we learn that natural coloured wool was used by the ancients. Indeed, it is of such that *Martial* thus expresses himself, where he says :

Non est lana mihi mendax, nec mutor æno,
— — — — — *me mea tinxit ovis.*

Theophrastus very nearly agrees with *Dioscorides* in the previously cited opinion.

Pliny thus expressly describes it. "Sponte provenit, seriturque. Similitudine erviliæ, verum spinosus ei caulis." In another place, he has given it the epithet *rubia*, doubtless alluding to its red roots, lib. xix. 3. The previously cited expression *similitudine*, has been conceived to allude to the stem of the plant running like a pulse upon the ground; and, perhaps, also, from the like effect being observed in it, as is produced by the roots themselves. It should be noticed, that in the middle ages this plant was called *varantia*, which implies a red dye; whereas *aurantia* signifies yellow. Until 1736, this plant was esteemed by dyers, farmers, and merchants only; but it afterwards obtained new importance in the philosophical world, from the following circumstance.

John Belchier, an English surgeon, having dined with a cotton-printer, observed that the bones of the pork, of which they had just been eating, were red;—he appeared surprised at the circumstance,—his host informed him, that "the colour was occasioned by the swine feeding on bran, which had been boiled in water where cotton cloth was coloured, and produced by the madder used in printing it." *Belchier*, to whom the effect was new, convinced himself of its truth by experiment, that the colour of the bones arose from the

madder used in printing, of which he apprised the Royal Society, detailing the process and giving the result; who published his letter in their Transactions for the year 1736. Hence all naturalists soon became informed; several of whom made new experiments, the result of which not only proclaimed the utility of the plant in commerce, &c. but also served to apprise them of a new secret in nature, which communicated many useful truths to the physiologist.

Besides the roots of madder, there is *galium*, or “ladies’ yellow bed-straw,” and other plants, which have a like affinity to madder in producing similar effects. It is, however, remarked, that such is not the case with *saffron*, or *woad*, nor with many other vegetable substances used in dyeing. The colouring takes place the soonest in young animals; it is also observed, that it is strongest where the bones are hardest and thickest. However, it does not attach itself to the softer parts; and appears to affect the milk and other juices but little.

Those ancient physicians, Galen and Dioscorides, have observed nearly the same effects, from certain roots they prescribed to their patients, in urine and other excrements. This effect has been also remarked by *Cardon*, in *De Subtilitate*, lib. xviii. p. 669. *Thurneisser*, in *Von Kalten, warmen und metallischen wassern*. Strasburg, 1612, fol. iv. 6, p. 78. *Porta*, *Magia Natural*. Frankf. 1591, 8vo. viii. 13, p. 355. *Castor Durantes*, *Herbarium novum*. Venet. 1617, fol. p. 400; and in the works of subsequent physicians.

The oldest of modern authors who observed this effect is *Lemnius*, a physician and native of Zealand, where the plant grows in abundance. See his treatise *De Miraculis occultis Naturæ*.

MANGANESE.

It has been observed by a recent writer,¹ that the term *glass-making* announces more than that art really performs. Though this may appear to some to be true, who consider that this, as in most other arts, where materials are easy of access, the term *making* may not probably be the best selected, which might have been found; most likely those who consider it in this light, would prefer that of *manufacturing*, which does not appear quite so objectionable. To us

¹ Beckmann.

it seems a better designation: and since the materials for every article of human production are found in nature, and as art has only to apply proper means, whatever art or industry can effect, if it be not probably designated, by the former term, that of *manufacturing* will probably comprehend it in all its branches. This is the case in every article, even of the most common and indispensable necessities of life: to instance the article *bread*; before it becomes so, the art of the husbandman, that of the grinder, the boulder, and lastly the baker, is requisite. Then we observe the variety of subsidiary contributive occupations which employ our species; whereas, the last-named, is only known as the *baker*, or BREAD MAKER: they all may properly be called bread manufacturers to a certain extent, but only one is entitled to the name of maker, by common consent. But this is left to the physiologist.

The art of glass-making, admitting the materials exist in the greatest abundance, assuredly requires much skill in the manufacturer; he should be intimately acquainted with the nature of the materials proper to be used, to assign their due proportions, to produce the desired effects; every accident or circumstance which can possibly, in the course of the operation occur, he should be prepared to meet. Requiring the most practical skill to make a proper selection, and the attention requisite to prevent accidents, he should be ever on the alert, or consequences fatal to the article will infallibly ensue. However, we profess not to teach the art; our business is only to collect such opinions of well-informed naturalists and philosophers, as are pertinent to the subject. That play of colours observed upon the surface of glass, and which lessens its transparency, may, it is conceived, in most cases, arise from the commencement of efflorescence. This is evidently the reason why polished rock crystal is so superior to the best crystal glass which can be manufactured. So much superior is it, indeed, that an inexperienced eye can readily recognise its superlative beauty, and perceive its splendour. This substance also requires the reforming hand of the artisan in mere polishing only, not fusion, which would be impossible without some addition. Glass-makers, who are desirous to preserve the purity of their article in the greatest degree, must use very little addition, and even lessen that they have employed, by exposing it long to the fire. But then it becomes so difficult of fusion, so very tough, that it cannot be treated in the usual manner. For this reason, when they desire to form the purest crystal, for artificial stones, prisms for optical experiments in regard to

refraction, they anneal the glass which has stiffened in the furnace, then break it, and form the pieces to proper size or shape, by grinding, &c. For common green, or blackish-green glass, every kind of siliceous earth is proper; but for a beautiful white transparent and perfectly clear glass, the purest sand or quartz, as well as the most pure of alkaline salts, are requisite. Even then the glass will be far from purity, unless a *proper* portion of manganese be added to the frit.²

However, to proceed with our original intention of collecting such relevant, and what we believe to be pertinent testimonies of ancient practice, and by the way, to gather useful and ingenious opinions we find variously diffused with regard to its manufacture.

We proceed to state, that although the art of manufacturing glass may have arisen from accident, like that mentioned by Pliny, lib. xxxvi. 26. § 25, our present cited author³ conceives glass might have originally been produced by accident; but his chief object is to inquire by what means the ancient artists were first induced to apply manganese in its composition, as it is very evident they did: this assuredly deserves inquiry, considering that it appears to be a mineral, whose outward appearance does not indicate any proximity or relationship with so transparent a substance. That the ancients discovered that iron stone was capable of communicating a great variety of colours and rich tints to glass, with that it is conjectured they produced their valuable blues, reds, purples, &c. Now, as manganese has been, and might very naturally be taken for a species of this stone, and from using it sparingly, they discovered its valuable property in giving a perfect transparency to the article; when it is used in larger proportion, it will give to glass a violet colour, something similar to the amethyst.

From what has been shown, it has been thought that the application of manganese, in the manufacture of glass, was the produce of accident; because it is justly noticed, that

² This term is perfectly understood by glass-makers and writers on the article: it denominates a certain mixture of sand, or siliceous earths, and alkaline salt. It appears to have been an Italian term, and to have come from the kitchen, *fritta*, derived from *fritto*, signifying something broiled or roasted. Thus it is used in Thomas Norton's poem, *Crede mihi sive Ordinale*, written in 1477, and often printed.

Durior species (vitri) vocatur freton,
Ex vitrorum fracturis id evenit,
Tinctura smaltorum vitriariorum
Non penetrabit illud, ut referunt

³ Beckmann.

where constituents are theoretically used, a certain knowledge of their properties is inferred, which, it is conjectured, could not have been the case here. Therefore, we think, not only the occasion of its original application, but also a probable cause is assigned for its being introduced into the composition at all; and also that it was so used from accident, rather than theory, is pretty apparent.

Manganese was formerly considered as a species of the magnet, from whence, it is conjectured, it obtained its name. The propriety of so considering it, appears from the circumstance of manganese containing a calx of iron in its composition.

Why the application of manganese, in a certain proportion, deprives glass of its colour, is a question of importance: it appears, the ancient chymists called in the aid of phlogiston, and the moderns have summoned oxygen to solve this difficulty. It is certainly a chymical question. Should this be, however, a false hypothesis, it will be found not to be the only question in which erroneous postulates have led the way to truth. Kepler, from an erroneous hypothesis with respect to planetary motion, discovered the true distance of the planets from the sun: although similar instances have been adduced in favour of hypotheses, which have done more harm than good. But, in the opinion of the author we consult, in examining the origin of ancient arts, we should not give credit for the original of any invention, till no other can be found. In regard to the art in question, he mentions one which has, he says, probability in its favour; which he thus submits. That the colour originally communicated by iron to various materials in a state of fusion, and particularly in glass, he says has been abundantly proved. It should excite no wonder that men should be induced to make experiments on colouring glass with various materials, and especially such as contained iron. Since it has been already suggested, that manganese resembles iron in appearance, it is presumed to have been occasionally employed, when it was discovered to communicate many very beautiful tints of colour. In order to do this with any degree of certainty, weighing it, it is thought, became necessary, in order to adjust its proportion to the vitreous mass, according to the colour required; these experiments being supposed to be made, it is easy to conjecture the probability of the experimentalists having discovered that a very small portion of it rendered glass perfectly transparent and colourless. It has been conjectured, that the nearer glass then, as it does now, approached to crystal,

the value was enhanced in proportion to that approximation.

Attempts have been made to assign a period for this discovery, but unsuccessfully; the nearest approach is, that it must have been anterior to the days of Pliny; as he often speaks of it in his writings, under the designation of *magnet*, as an ingredient proper for this purpose; it is also observed, that the proper distinction between manganese and the magnet itself, was not made till since the days of Agricola and Kircher.

In another passage in Pliny, he observes, *alabandicus* flows in the fire, and is fused in the glass-houses. By that term, he nevertheless appears to understand a kind of marble; also as such Isidorus seems to notice it; he, the last author, repeats the word more than once. As a calcareous earth, it might be added to promote the fusion of the sand. Camillus Leonardus, it is said, considered the *alabandicus* as manganese, which admirably assimilates with enamel: and although we possess no evidence of its anterior application, in that kind of painting, it is confidently alleged by several eminent modern antiquaries, that those beautiful specimens observed upon vases of Grecian workmanship, and all the splendid colours there displayed are the produce of manganese; and likewise those so surprisingly brilliant in the antique lamps of that country.

The celebrated Count *Caylus*,⁴ whose experience in matters of this nature is confessed, at the time the votaries of taste and admirers of antiquity are happy in acknowledging the benefits which the modern world have derived from his successful inquiries; and also Genssane,⁵ as we understand, have not scrupled to avow that the Greek enamel, and also the colour in their lamps, were produced by the agency of manganese.

That great regenerator of the practice of ancient physic to the moderns, the *Arabian*, AVICENNA,⁶ whose name will stand for *system* itself, has described manganese so clearly, so completely and ably defined it, and not only as to the apparent character, but the genuine nature of this mineral, that he has left it to others only to transcribe what he has

⁴ Recueil d'Antiquités, i. p. 86.

⁵ Traité de la Fonte des mines par le feu du Charbon de Terre, Paris, 1770, 2 vol. 4to. i. p. xv.

⁶ Canon Medicinæ, lib. ii. tract. 2, cap. 470, de Magnete. In the edition, Venetiis apud Iuntas, 1608, fol. i. p. 356 and 357, he has made so complete a distinction between it and the magnet, that he treats of those substances in separate sections.

said respecting its nature and properties, of which he has left a complete and judicious definition.

Albertus Magnus, who lived a century later, in his book *de Mineralibus*, lib. ii. tract. 2. cap. 11, in the second part of all the works of this multifarious writer, Lugduni, 1631, fol. p. 234. Roger Bacon, in his *Alchemia*, in Manget's *Biblioth. Chemica*, p. 614. Basilius Valentine, in his *last Test.* ii. p. 133. Camillus Leonardus, *Speculum Lapidum*, lib. i. cap. 9, p. 31, says, *Quidam lapis, ex quo nostri vitrarii vasa dealbant.* Lib. ii. cap. 7, p. 71: *Alabandicus niger in purpureum vergens lapis est a loco nomen sumens suæ primæ inventionis; ab igne colliquatur ac funditur more metalli; utilis ad vitrariam artem cum vitrum clarificet et albefacit.* Also Mercati, in *MetallotECA*, p. 148; Neri, and a great many others, have spoken in the plainest terms of its appearance and application.

The various terms employed by all these writers, descriptive of this substance and its uses, leave us not in doubt but the same object was intended to be described; although the expressions they have used are various, *i. e.* *magnesia*, *magnosia*, *magnasia*, *manganensis*, and *mangadesum*; yet the context is sufficiently explanatory. The French call it *magalaise*, *meganaise*, and *magnese*. The Latin description has also a pronomen, *sidera*, which has evident reference to the Greek term for iron. Mercati deduces it from *mangonizare*, because potters besmear their ware with this mineral.

The best manganese is presumed to be produced from a mine in Perigord, a place in Guyenne. Wallerius, we understand, gave this the preference.

MILL-SAWS.

The invention of the plumb-line and saw, with other useful articles in mechanics and handicrafts, are usually ascribed to that great, that universal genius, *Dædalus*; although others give the merit of the invention to one *Talus*, the nephew of *Dædalus*, and say, that upon this occasion the discovery was made. *Talus*, they tell us, having found the jaw-bone of a snake, cut a piece of wood in two with the teeth; thence, they say, he invented the saw: his maternal uncle and master, they add, was so jealous of this ingenious invention, that he slew the young man; and the mode of the discovery of the murder is this way accounted for: some

persons saw Dædalus covering up the grave of his victim, and asked what he was doing? "Oh," says he, "I am only burying a snake." How much credit may be due to this relation, we do not take upon ourselves to determine. *Pliny*, and it appears *Seneca*, were of the former opinion; whilst *Diodorus Siculus*, *Apollodorus*, and others hold the latter. The youth is named by some *Perdix*. However, it appears to rest between these two, no other claimant appearing. *Ovid* says it was not the jaw of a snake, but the back-bone, or spine of a fish.¹ The former, however, appears to be the most rational opinion as to its origin, as it is conjectured, 1st, that the vertebræ would not be sufficiently strong; 2dly, that the joints are too far apart, and also too large.

The Grecian saw is said to have been much the same as that instrument which the moderns now use. This idea is corroborated by an ancient painting discovered in *Herculaneum*; likewise from an antique representation of this instrument, given by the celebrated *Montfaucon*,² a name whom all who have a taste for classical antiquities must venerate.

The preceding observations, however, have relation to the subject of this article only, inasmuch, as they are introductory to what follows.

The most beneficial and ingenious improvement that has been made in saws, was in the invention and introduction of machinery called saw-mills; which in woody countries, as well as for delicate and fine veneers, are of the greatest utility: in the former case, wood forms the chief article of commerce, when labourers are scarce; in the latter, it may be cut nearly as thin as a sheet of paper: as we are informed is the case with mills of this description erected in the public works at *Plymouth*.

They are declared to have been invented in Germany, as early as the fourth century, upon the small river *Roer* or *Ruer*: for although *Ausonius* speaks of water-mills for cutting stone, he says nothing of mills to cut timber. The art of cutting marble with a saw, is very ancient; *Pliny* thinks it was invented in *Caria*; at least he knew of no palace or building incrustated with marble older than the palace of King *Mausolus*, at *Halicarnassus*. *Vitruvius* also names the same circumstance, although he uses different terms

¹ *Metamorph. lib. viii. 244.*

² *L'Antiquité expliquée et représentée en Figures. Tome iii. Paris, 1719, fol. par. 2. pl. 189, p. 341.*

for expression of the same sense: he commends the beauty of its marble, whilst Pliny speaks of its different kinds: the former viewed it as an architect, whilst the latter inspected it as a naturalist. It certainly does also appear from other writers, that the harder and precious kinds of stones were cut in the same manner, as Pliny speaks of a building adorned with agate, cornelian, lapis-lazuli, and amethysts. Yet there is no mention made of mills for cutting wood; or, admitting they had been invented, it is probable they shared the fate of many other ancient inventions: had been forgotten, or else some considerable modern improvement had been made in their construction.

Since the time of their first invention, they have been erected in various parts of Europe, and even carried into and beyond the Atlantic Ocean. There appears to have been one erected in the vicinity of Augsburg, as early as 1337; at Erlinger, in 1417.

Upon the discovery of the isle of Madeira, in 1420, the Infant Henry sent settlers to that island, and caused European fruits of every kind to be carried there, and amongst other European productions, saw-mills, and other machinery, to cut the valuable timber found there into portable pieces, which were afterwards transported to Portugal. In 1724, the city of Breslau had a saw-mill, which produced the yearly rent of three marks.³ In 1490, the magistrates of Erfurt purchased a forest, and built a mill of this description. In Norway, a country covered with wood, there was one built in 1530. This mode of manufacture was called the new art; and because the exportation of deals was by that means increased, a royal impost was introduced by *Christian III.* in 1545, called the *deal-tythe*. Soon afterwards, *Henry Ranzau* caused the first mill to be built in *Holstein*. In the year 1555, the Bishop of Ely being ambassador from the Princess *Mary of England* to the court of Rome, saw a saw-mill in the neighbourhood of *Lyons*: the writer of his travels thought it worth particular description:—"The
 " saw-mill is driven with an upright wheel; and the water
 " that maketh it go, is gathered whole into a narrow trough,
 " which delivereth the same water to the wheels. This
 " wheel hath a piece of timber put to the axle-tree end,
 " like the handle of a brooch, and fastened to the end of the
 " saw, which being turned with the force of the water,

³ Peritsol's *Itinera Mundi*, printed with T. Hyde's annotations, in Ugolino, *Thesaur. antiquitatum sacrarum*, vol. vii. Venetiis, 1747.

“hoisteth up and down the saw, that it continually eateth
 “in, and the handle of the same is kept in a rigall of wood
 “from swerving. Also the timber lieth as it were upon
 “a ladder, which is brought by little and little to the saw
 “with another vice.” In the sixteenth century, there
 was a grand improvement made in this machine by having
 several saws affixed to one beam, by which timber could
 be cut into several planks or boards, and of any thickness,
 at the same time. *Pighius* saw one of these, in 1575, upon
 the *Danube*, near *Ratisbon*.

In England, saw-mills were at first as little encouraged
 as printing is in Turkey, and from the same motive. When
 attempts were made to introduce them, it was said the
 sawyers would be deprived of bread. For this reason, it
 was found necessary to abandon a saw-mill erected by a
 Dutchman, near London, in 1663. However, in 1700, one
 Houghton laid before the nation the advantages of them,
 but he expressed his apprehension that it might cause a
 commotion in the populace. What he feared, actually came
 to pass, for on the erection of one by an opulent timber-
 merchant, by desire of the Society for promotion of arts, &c.
 in 1767 or 1768, who caused one to be erected and worked,
 driven by wind, near Limehouse, under the direction of
James Stansfield, who had learnt in Holland and Norway,
 the art of constructing them, a foolish mob assembled and
 pulled it to pieces. The loss sustained by the individual
 was, of course, made good by the county, and some of
 the rioters were punished. There had been, we understand,
 a similar mill erected in Scotland many years before.

MUSEUMS.

Should the report be true which we have from antiquity, that
 written accounts of those who had recovered from sickness
 were deposited in the temple of *Æsculapius*, these it is
 conjectured, furnished the first idea of collections of this
 nature. That this was so, we have the testimony of Hip-
 pocrates, who himself, did not disdain to consult them.
 Fragments of these collections have been also collected
 and published by *Mercurialis*, in his work *De Arte Gymnas-
 tica*, i. c. 1.

There is also the most ample room to believe that rare
 animals, plants, and minerals were collected and deposited
 in the temples; even some of the ancients occasionally
 vowed to deposit their hair in certain temples, as we read

was the case of *Berenice*, the beautiful wife of *Ptolemy*, previously mentioned; vide article *Astronomy*. That those collections tended much to increase the knowledge of natural history, cannot be questioned. Natural objects of uncommon size and beauty, having been from the most ancient of periods consecrated to the gods, no place became so proper for their preservation as their respective temples, the sanctity of which places much increased the value of the articles; hence also they continued to awaken curiosity from their antiquity. When *Hanno*, the Carthaginian, returned from his distant voyages, he brought with him two skins of hairy women, found on the islands of the *Gorgades*, and deposited them in the temple of *Juno*, where they continued till the destruction of that city, as *Pliny* informs us, in lib. vi. c. 31. The horns of a Scythian animal, in which the Stygian water could be contained, which destroyed every other vessel, were sent by *Alexander* as a curiosity to the Delphian temple. *Æliani Hist. Animalium*, lib. x. c. 40. Those monstrous horns of the wild bulls called *Erythræan*, which committed such destruction in Macedonia, were, by order of King *Philip*, hung up in the temple of *Hercules*. The unnaturally formed shoulder-bones of *Pelops* were deposited in the temple at *Elis*. The feelers, called horns, of the Indian ants, were deposited in the temple of the *Erythræan Hercules*. A crocodile, found in the attempt to discover the source of the *Nile*, was preserved in the temple of *Isis*, at *Cæsarea*.¹ A large piece of the root of a cinnamon tree, as the same author informs us, was kept in a golden vase in *Rome*, which he examined.² The skin of that monster which *Regulus*, with his army, met with in *Africa*, was deposited in a Roman temple. In the temple of *Melitæan Juno*, were an immense pair of elephant's teeth, which were carried away by *Masinissa's* admiral, and transmitted to that prince; who, though he set a high value on them, restored them when he understood they were taken from a temple.³ The head of a basilisk was exhibited in some temple of *Diana*, as *Scaliger* informs us. The bones of that sea monster to which *Andromeda* had been exposed, were preserved at *Joppa*, and afterwards brought to *Rome*.⁴ The monstrous tusks of the celebrated *Calydonian boar* were brought to *Rome*, after the defeat of *Anthony* by *Augustus*, and deposited in the temple of *Bacchus*.⁵

¹ *Pliny*, lib. v. cap. 9.

² Lib. xii. cap. 19.

³ *Cicero*, in *Verrem*, iv. c. 46.

⁴ *Plin.* lib. ix. cap. 5, and lib. v. c. 13, 31.

⁵ *Pausanias*, in *Arcad.* cap. 46 and 47.

Apollonius informs us, by Philostratus his biographer, that he saw some of those nuts in India, which were preserved in the Grecian temples as curiosities. Lib. iii. c. 5. Numberless other instances might be collected, but it is conceived the preceding may suffice.

We next observe upon collections made by princes and great men. Suetonius says Augustus had a collection of natural curiosities. *Alexander* the Great gave directions for all huntsmen, bird-catchers, and fishermen to send whatever animals they could procure to Aristotle. There is little room to doubt that *Apuleius*, *Theophrastus*, and *Pliny*, had all of them made such collections; as those naturalists accurately examined whatever they found, and, allowing for the infancy of natural science, correctly described such productions. *Theophrastus*, in particular, undertook distant journeys for that purpose; on the Getulian mountains, he collected some rare specimens of petrifications, which he considered to have been part of the effects of Deucalion's flood. Modern naturalists, with philosophers, have much cause to regret that the writings of this great philosopher, respecting these subjects, are lost.

Doubtless, a principal cause why the ancients had so few natural objects preserved, must have arisen from their ignorance of the best mode of preservation. They certainly used the best means they knew for that purpose, when they preserved them in honey, brine, or wax; but as these were inadequate for common inspection, their inutility may be assigned as the most probable cause for such neglect. The best preservative of perishable substances, that was first suggested, there is room to believe, was salt. *Dion Cassius* relates that Pharnaces caused the body of his parent, *Mithridates*, to be deposited in salt-brine, that it might be transmitted to *Pompey*. A *hippocentaur*, probably a monstrous birth, being caught in Arabia, was brought alive to Egypt, according to *Varro, de Re Rustica*, lib. ii. c. 4. It died there; but was preserved in brine, and afterwards sent to Rome; the Emperor deposited it in his collection, where *Pliny* saw it, as did *Phlegon*. Another *hippocentaur* was transmitted to the Emperor *Constantine*, at *Antioch*, of which *St. Jerome* bears evidence. A large ape, of the order of *Pan*, sent by the Indians to *Constantine*, happening to die upon the road, from its confinement, was preserved in salt, and so conveyed to Constantinople. Even as late as 1113, a like process was pursued with the body of *St. Guibert*, that it might keep during a long journey in summer;

the same means had been resorted to by the religious, in the fifth century, to preserve the heads of the first Christian martyrs; also, that honey was used for the same purpose, the following instances will prove. The most early of people, the Assyrians, practised it according to Strabo, lib. xvi.

The body of *Agesipolus*, King of Sparta, who died in Macedonia, was sent home in honey; so also were those of *Agesilaus* and *Aristobulus*. The deceitful *Cleomenes* caused the head of *Archonides* to be put in honey, and had it always placed near him when he was deliberating upon any affairs of importance, in order to fulfil the oath he had made to undertake nothing without consulting his head, as *Ælian* relates, in *Var. Hist.* lib. xii. cap. 8. Some have said this was the mode in which the body of Alexander the Great was preserved, whilst others affirm it was embalmed in the Egyptian fashion. The body of the Emperor Julian II. was placed in honey mixed with spices.

In ancient times, honey was also used for the same purposes for which we now use sugar, it was in particular applied for preserving fruits, which is done at present in many places. In order to preserve the freshness of the celebrated purple dye of antiquity, honey was poured over it. By the same means, also, were natural curiosities preserved; such was the case with the hippocentaur last mentioned. Likewise, that the early Assyrians, Scythians, and Persians used wax, a number of instances could be cited to prove.

To bring this practice nearer to our own times, and even to our own door. An order, which may be called standing, is, we are told, in existence, which directs that the kings of England shall be wrapped in waxen cearcloth. In 1774, when the grave of Edward VI. was opened, who died in 1307,¹² the body was found entire, so closely wrapped in wax-cloth, that even the lineaments of the face could be discovered, as we are informed by *Dart*, in his *Antiquities of Westminster*, vol. ii. p. 28.

The body of Johanna, mother of Edward the Black Prince, and also Elizabeth Tudor, daughter of Henry VII. were interred in the same manner, as was that of George II. In the *Archæologia*, p. 402, is the following entry: "To Thomas
" Graham, apothecary to his Majesty, for a very fine double
" cearcloth, with a large quantity of very rich perfumed

¹² Liber Regalis, in the article *De Exequiis Regalibus*.

“ aromatic powders, &c. for embalming his late Majesty’s “ royal body, £125.” In brief, it is quite clear that whatever tends to the exclusion of atmospheric or common air, will also promote the preservation of the most perishable substances, whence it follows, that the more effectually they are secured against its access, the longer and better will such substances be preserved: hence, the superior efficacy of spirit of wine may be inferred.

It was chiefly in the courts and treasuries of princes that very curious appearances were preserved during the middle ages. In the old treasury at Vienna, we are told, and in that of St. Denis, was exhibited the claw of a *griffin*, sent by the King of Persia to *Charlemagne*, the teeth of a hippopotamus, and other rare productions.

The various private collections which have at different times been formed by individuals, we find commenced as late as the sixteenth century. Among these may be reckoned one made by *Hen. Cor. Agrippa* of *Nettesheim*; *Nic. Monardes*, *Paracelsus*, *Val. Cordus*, *Hier. Cardan*, *Matthiolus*. 1577; *Conrad Gesner* and *George Agricola*, 1555; *Pet. Bellon*, 1564; *W. Rondelet*, 1566; *Thurneisser*; *Abraham Ortelius*, 1598, and several others in Germany. Sir *Hans Sloane*, about the latter end of the seventeenth century; Sir *Ashton Leaver*, about the middle of the eighteenth century; Mr. *William Bullock*, of Liverpool, at the end of that century; Sir *Joseph Banks*, and many others in England. *Quickelberg*, a Dutch physician, published a catalogue of his collection in 4to. at Munich, in 1565, intituled *Inscriptiones vel tituli Theatri amplissimi, complectentis rerum Universitatissingulas Materias et Imagines*; this was only an introduction to a larger work. *John Kentmann*, a learned physician of Torgau, sent a catalogue of his collection to *Conrad Gesner*, who caused it to be printed. It is seen that the order of *Agricola* is chiefly followed in this arrangement. In France, a learned potter, named *Bernard Palissy*, made a large collection, of which he published a catalogue. *Michael Mercati*, an Italian physician, at about the same period, made a large collection, and copiously described them. *Ferdinand Imperati*, a Neapolitan, also collected extensively, and published his catalogue in 1599. *Fran. Calceolari*, of Verona, likewise collected, and published his catalogue in 1677.

The Linnean Society in London also possess an ample and rare collection of scarce and valuable productions, and which are all most methodically arranged, according to the system of its great nominal patron, and improved by subse-

quent observations. This learned body owes much for the arrangement of its treasures, we are told, to Dr. Smith.

It would be unpardonable not to notice the great and various collection of models, &c. in useful arts, manufactures, &c. of recent improvements, which are formed by the Society for Encouragement of Arts, Manufactures, and Commerce, in London, in the Adelphi, since its first establishment by Mr. Sheepy.

But among the first museums in Europe; nay, from what comparisons we have heard made by intelligent observers, as well English as foreign, we may say in the world, the British Museum claims a preference, as well from its multifarious collections of natural history in every department, which can create attention, to the various rich produce of nature: as well as to the most inestimable of antiquities.

To enrich this rare national collection, the whole world, ancient as well as modern, has contributed. We possess the finest specimens of the sculptor's art, from its first dawning in Egypt till its latest close in Greece; in its most polished periods particularly, besides what Rome has yielded. It is presumed there is no library in the world calculated to compare with it in the richness, variety, elegance, and number of its books and manuscripts, which is daily increasing.

For the following particulars of this magnificent institution, we are indebted to the synoptical catalogue of the contents of this establishment, published in 1815, by order of the trustees, and are extracted from the prefatory observations, where it is said, "The project of a public establishment of this nature, (i. e. *national*,) was first suggested by the will of Sir Hans Sloane, late of Chelsea, in the county of Middlesex, Bart. who, during a long period of eminent practice in physic, had accumulated a very large collection of natural and artificial curiosities, together with a very numerous library of printed books, as well as MSS. and who, being well aware how much science is benefited by the opportunities which large aggregates of objects afford for comparing them together, and marking their less obvious differences, was very solicitous that his sumptuous museum, which he declared had cost him upwards of £50,000, should, if possible, be preserved entire, and permanently dedicated to public utility. With this view, he directed that the whole of his museum should be offered to the British parliament, for the moderate sum of £20,000; that should this tender not be accepted, the offer should be then made to certain

foreign academies named in the will; and that should these also decline the offer, his executors should then be at liberty to dispose of it, in such a manner as should appear to them most eligible.

“ Sir Hans Sloane died in the beginning of the year 1753: the offer, directed in his will, was immediately made to parliament, and was accepted without hesitation. Before the expiration of that year, an act was passed, which ordered the payment of the stipulated sum to his executors, and vested the property of the museum in trustees, for the use of the public.” The library consisted of, in printed books and MSS. including prints and drawings, 50,000 volumes, with a great assemblage of other valuables, classed under the heads of coins and medals; antique idols and utensils; cameos, intaglios, seals, &c.; vessels and utensils of agate, jasper, &c.; anatomical preparations of human bodies, parts of mummies, calculi, &c.; quadrupeds, and their parts; birds, and their parts, eggs, and nests; amphibia; crustacea; shells, echini, entrochi; insects, corals, sponges, zoophytes; stones, ores, bitumens; salts, &c.; volumes of dried plants; mathematical instruments; miscellaneous artificial curiosities; MS. catalogues of the whole museum, 38 vol. folio, and 8 quarto. To this large collection, forming a beginning for a scientific repository, the same act directed that the very valuable library, which had become public property, collected by Sir Robert Cotton, in the time of Elizabeth and James I. and increased by his son Sir T. Cotton, in the subsequent reign, should be made a part of the above Sloanian collection, and both form an intended national museum. The Cottonian library chiefly consisted of authentic documents relative to the history, antiquities, laws, &c. of this country and of Ireland, then consisting of 861 volumes, the contents of which are collected in a preface to the catalogue, compiled by Dr. Smyth, published in 1696, and an enlarged one, printed in 1802, by order of his Majesty. Besides these MSS. there are also a considerable number of coins, Saxon, Roman, and British.

To these were added the very splendid library of Major Edwards, consisting of about 2000 volumes of English, French, and Italian books, bequeathed to the trustees of the Cottonian library, with a sum of £7000, for erecting a building or repository, for the reception of both libraries, which had been vested in the public funds since 1769, the annual produce thereof had been expended in the purchase of books, coins, &c. which had continually increased the collection.

With the same liberal spirit parliament had also, for the purpose of promoting the interests of literature, purchased the very valuable collection of Edward, late Earl of Oxford, and also the addition made by his son Robert, for £10,000, under a specific stipulated condition, that the Harleian collection was to be kept together. The catalogue of this collection (which consists of 7600 volumes, and upwards of 40,000 original MSS. rolls, charters, and other authentic documents of great antiquity, and in almost all languages) was printed in 1759, in 2 vol. folio.

To defray the expenses of these several purchases, and to provide a repository for their reception, parliament resolved to raise £100,000 by way of lottery, which netted £95,194 : 8 : 2. This sum, with the several previous aggregations, was vested in an incorporate body of trustees, consisting of the first personages in the kingdom for rank, situation, and literary fame; conferring on them ample powers to take such measures as they should deem expedient for disposition, regulation, and management of the institution, to bear the name of the **BRITISH MUSEUM**. The very magnificent and extensive palace of the late Duke of Montague was purchased for the reception of the splendid collections, which were first opened for the inspection of the public the 15th January, 1759.

It has since been gradually enriched by many other very valuable collections. The royal library of George II.; a collection of pamphlets by his present Majesty, who was also graciously pleased to direct that the Egyptian antiquities, collected by the French army in Egypt, and made a prize of war, should be there deposited; the Hamiltonian collection, chiefly of Etruscan antiquities; the Lansdown MSS.; the Hon. Charles Greville's minerals; the Hargrave legal library; the Towneleian collection of Grecian antiquities; Greenwood's bird's; Hatchett's minerals; Halhed's Oriental MSS.; Cracherode's bequests, consisting of valuable prints, gems, &c; Tyssen's Saxon coins; Dr. Bentley's classics; Roberts's English coins; Dr. Birch's most valuable library; Brander's fossils; Sir Joseph Banks's collection from foreign islands, chiefly in the South Seas. And lately, Lord Elgin's inestimable collection of Grecian sculpture, &c. &c. &c. are added to these stores of art and science. The library receives constant additions by the provisions of several acts of parliament, enjoining all authors and publishers, under certain penalties, to deliver, at Stationers' Hall, a copy of every work which they publish, for the library of the British Museum.

NIGHT-WATCH.

Night-watch is an extremely ancient regulation in all civilized and well-governed communities. It often occurs in the sacred volume, and in the book of Psalms there is an extremely pertinent observation tending to illustrate its antiquity: "Except the Lord keep the city, the WATCH-MAN *waketh* but in vain." *Psalms* cxxvii. 1. The observation in the latter part of the sentence evidently points to a *night-watch*; not but that we are at perfect liberty to presume, what was the fact, that watchmen or centinels had been established, since the first of time, in the day; which, in those early periods, must have been particularly necessary, from the wild and predatory habits of many oriental nations, certain parts of whom lived by rapine. To bring one instance alone in support of this our proposition, we quote the 15th verse of the 2d chapter of Job, where we observe the first of the misfortunes of that celebrated sufferer arose from a robbery and murder by the Sabeans; they stole the cattle, and slew the servants of the magnanimous patient. Likewise, Dr. Potter, in the 2d volume of his *Archæologia Græca*, lib. i. cap. 4, assigns as a reason for the ancient Grecians always going armed, because, thinking it unsafe to adventure themselves abroad without sufficient defence against aggressors. Plutarch also informs us, that when *Theseus* proposed his journey from *Træzen* to *Athens*, his relations would have persuaded him to go by sea, for he says, it was at that time very dangerous to travel by land to Athens, no place of the country being free from thieves and murderers; for that age produced a set of men, for strength of arm, swiftness of foot, and vigour of body, excelling the ordinary race of men, and in labour and exercise indefatigable; yet making use of these gifts of nature to nothing good or profitable to mankind; but rejoicing and taking pride in insolence, and pleasing themselves in the commission of barbarous and unheard-of cruelties, in seizing by force whatever fell into their hands, and practising upon strangers all manner of outrages; who imagined that civility and justice, and equity and humanity, (which they thought were commended by many, either from want of courage to commit injuries, or from the fear of receiving them,) nothing at all to concern those who were most daring and strong.

Having now established this ancient disposition in the

people, we submit, if they would perpetrate such outrages in the open light of day, the shade of night was much more likely to afford them opportunity to practise their unlawful and violent occupation even in cities. Therefore, having by those instances, deduced inference from them to establish the *necessity*, — it follows, we would also suggest, that the prudence and precaution of men should teach them to be upon their guard: and since fear suggested the propriety of establishing centinels by day, much more would the same motive instruct to provide for security by night, by the establishment of proper watchmen, as well to resist any puny attempt of a solitary thief, as to forewarn a city of greater approaching danger, threatening the persons or property of the inhabitants.

Admitting there was no necessity from fear of robbers in large well regulated societies, yet there is an enemy it assuredly behoves all people to guard against, and which must have existed in ancient days as well as it does now: we mean the subtlety of *fire*. And without the intelligence of ancient historians, poets, and other delineators of ancient manners, which may be produced in vast abundance, to prove this necessity, it is apparent, in the previous anecdote we have related from the history of *Omar*, the third caliph of the *Saracenic* empire, by the conduct of *Dames*, at the siege of *Aleppo*. A *watch* is named likewise where *Ammianus Marcellus*, xxiv. 16. reports that such was the custom among the *Persians*: as the *Persian* centinels were singing (a centinel and watchman is in this case nearly a synonymy) at the time they were surprised by the *Romans*.

We have, we think, established the necessity for the existence of a watch in most countries, in a very ancient period; it now alone remains to see the names by which they were called by the *Greeks* as well as the *Romans*.

Night watchmen in Greece were called *κωδωνοφοροι*, *bell-bearers*, or what we call *bellmen*, because whilst going their rounds they gave a signal with their bells, which the centinels were obliged immediately to answer. Vide the Scholiasts upon the *Aves* of *Aristophanes*, ver. 841; whose words have been inserted by *Varinus* in his *Lexicon*, p. 461, and found to be exactly of the same class with the *περιπολοι την πολιοι φυλαττοντες* in *Pollux*, viii. cap. 9. *The watchmen in different quarters of the city have small bells, that they may make signals to each other when they think proper*. Hence, it appears, the bells did not serve to announce the hour, as some have thought, because first they appear for *signals* agreed upon; and secondly, those signals depended upon the cir-

cumstances of the moment, to be judged of by the watchmen.

In Rome the watchmen were termed *triumviri nocturni*, *cohortes vigilum*, &c.

It is said, at a period when Augustus was apprehensive of nocturnal commotions, as a means to prevent them, he tried the pretext of suggesting that such precautions were from the apprehension of fires only. This does not permit the inference that watchmen were then *first* established in Rome in the time of that Emperor; in most things Rome took Athens for its model, and surely in so sound a feature as this policy, the prototype was not forgotten. We may hence suppose that he doubled the watch. Cassiodorus says, when orders were given to a *præfectus vigilum*, that it was said to him “*Eris securitas soporantium, munimen domorum, tutela claustrorum, discussor obscurus, arbiter silentiosus, cui fallere insidiantes fas est, et decipere gloria.*” *Var. vii. 7.*

Subsequently to the introduction of the Egyptian invention of the water-clock in Greece and Rome, the watchmen of those cities might have announced the hour; but previous thereto the watch of the night might be announced, as might the *συναί* at Athens, and the *horæ* at Rome; but, upon the most minute search no trace of such practice is to be discovered, which certainly appears very extraordinary, because the nominal divisions of the night took their original from the office of a *watch*. And when we consider the solicitude of some voluptuaries, and indeed of the most respectable of citizens to be informed of the progress of time, the more strange is the omission. It is reported by historians that all people of consequence in Athens and Rome kept servants of both sexes in their houses, whose duty it was to announce to them the hour even in the day; those servants chiefly consisted of boys and girls whose duty was exclusively to attend upon certain branches of the family, similar to our footboys and ladies' maids. The reproach of *Petronius*, upon *Trimalchio*, a celebrated voluptuary, that he had a *clepsydra* in his dining-room, and a servant stationed near it to proclaim the progress of the hours, that his master might know how much of his life-time he had spent, for he did not wish to lose a single moment without enjoying pleasure, tends to prove our assertion. This, and like instances, affords a proof of general habits in this particular.

Although we read of no intimation of the time being given by the ancient night-watch, yet that the military portion of their population were in the habit of dividing the time by night as well as by day is certain, from the evidence

of both sacred and human authors; they denominated those grand divisions by first, second, third, &c. watch. *Cicero*, comparing the life of a civil with a military officer, says, "The former is awaked by the crowing of the cock, and the latter by the sound of a trumpet." An ancient poet also says, that "The cock is the trumpeter which awakens the people in the time of peace." This also confirms the words of the orator. The ancients, and particularly in the country, were much better acquainted with the progress of time, from the course of the stars, than are the modern vulgar.

In the year of Christ, 595, *De la Mare* informs us in his *Traité de la Police*, that in the time of *Clothaire II.* a prince contemporary with *Charlemagne*, the night-watch, or *guet*, was established in France; if this be correct, we conceive it to have been the first regulation of the kind in Christian Europe. It appears, that at first, the citizens were obliged to keep watch in their turn, under the command of a *miles gueti*, who was also called *chevalier*. After general tranquillity had been restored, a custom was by degrees introduced of avoiding the duty of watching, on paying a certain sum of money, until, eventually, permanent *compagnies de guet* were established in *Paris, Orleans, Lyons, &c.*

It has been alleged, that calling out the hour is an invention of modern times, and also that it was first practised in Germany, and not till after the erection of city-gates. Such a regulation appears to have been a very useful institution, let whoever will have introduced it. It is particularly convenient to people who are obliged to attend to business; and it is also most consolatory to those who cannot sleep: to such, the voice of the watchman appears to enable the hypochondriac, just awakened from uneasy slumber, to recognise his existence among the communicative world. The hours to such people may be also enumerated, to tell how long they have to turn them upon their weary couch, before the theatre of their existence is blessed by the pure light of the all cheering sun.

It appears, that in 1588, the Elector, John George, appointed watchmen in Berlin; however, in 1677 there were none employed in that capital. We are told, that *Montaigne*, whilst on his travels in Germany, in 1580, thought the calling out of the night-watch a very singular custom; hence, it appears, it was not then usual in France. "The watchmen," says he, "went about the houses in the night-time, not so much on account of thieves, as on account of fires and other alarms. When the clocks struck, the one was obliged to call out aloud to the other, and to ask what it was o'clock,

and then to wish him a good night." Mabillon, who likewise made a literary tour into Germany, describes the calling out of the hours as a practice altogether peculiar to that country.

In that country, also, watchmen were stationed on steeples by day and night, and who, every time the clock struck, were obliged to give proof of their vigilance by blowing a horn. This practice is said to have been established on a permanent footing first in Germany; a custom very rare beyond the boundaries of that empire, and even at this day we do not know if it is entirely abolished. In feudal times, it might have been much more necessary than it is at present, for those tyrants of the day were generally quarrelling with each other, and then each petty chief could raise a considerable force to distress a neighbour or annoy a town, and even to plunder a single traveller. The steeple watchmen upon such occasions must have been very serviceable.

The proprietors of castles kept them for the same purpose. The person generally appointed to such stations in cities, was an officer called the *city-piper*, now known as the *town musician* in Germany, who at first had a room assigned him in the steeple, where he occasionally had his wife, until it was thought a profanation of the sacred place; afterwards he had a small house near the church: in either case his residence was called the *hausmann's thurm*. This is the case now, it is said, at *Gottingen*, as well as at *Hartz*, and *Halle*. He was not permitted to come down from his station on any pretence. Intimation of the approach of enemies was given by firing a musquet, and hoisting a red flag to the way of the enemy or stranger's approach. In case of fire, they blew a horn, and gave an intimation of the hour by striking on a board, the usual practice, we are informed, in *Russia* and in *China*. It should have been mentioned, that from old records, it appears, the proprietors of castles in *Wales*, *Ireland*, and *Burgundy*, constantly kept watchmen stationed on some conspicuous part of the edifice. Illustrations of this practice will be discovered in the *Macbeth* of *Shakspeare*.

ORPHAN HOUSES.

These establishments are most assuredly among those which offer the highest eulogiums to human nature. Institutions, which derive their original from principles that must be

universally approved. Let us view them in whatever situation we may, they appear of so benevolent, so divine a complexion, that be the founder of ever so exceptionable a character, in other respects, his charitable disposition to the perfectly friendless, appears so amiable a trait in our eyes, that we cannot withhold the tribute of our admiration, but are constrained to pay a due reverence to his memory. Without meaning to incur the charge of intrusion upon the offices of the sacred character, we may, we hope, be pardoned, if we observe that true indeed is the sentiment which apprises us of the good effects of humanity here, to the individual, and the blessings of a future state which await the benevolent soul. It will be remembered that Saint Paul enforces the practice of charity, in his usual and energetic manner, as the most supreme of all the virtues: and, in the present instance, it really appears to partake of a nature so divinely exalted above common eminence, that it precedes every other of the most virtuous affections of the rational creature. Can any claim of suffering humanity exceed that of the helpless, unoffending, and unprotected? Is there any appeal which can be made to human nature so strong as the one coming from the fatherless,—the friendless,—the destitute? The little innocent offspring of either virtuous or vicious parents, is itself guiltless; unconscious of those passions which affect the more mature of its fellow creatures; if it be the offspring of good parents, it requires protection from kindred virtue; if of the worthless,—itself is no participator of its parents' crimes: but alike unconscious of good and evil, its wants alone demand our care. These will plead strongly in the kindred heart of virtue, to attend to the voice of its distress. These imperious appeals to our benevolence, appear to have been strongly felt by our species in the very earliest ages.

From the historical relation of *Ælian*, we learn, that at Boeotian Thebes, for one instance, the state took care of such objects, and also of all the children of poor parents. From the words of that author, it is understood that such children were usually adopted by people who purchased them for that purpose; and it may appear that the sale of those children somewhat resembled a *Dutch auction*, where they were sold to whoever offered the *least* for them; but it may be, that the historian meant to be understood they were to be consigned to whoever offered *any thing* for them, be it ever so little. Our Grecian historian, Archbishop Potter says, “The children of those who fell for the glory of the Athenian commonwealth were carefully educated, at the public

charge, till they came to maturity, and then presented with a complete suit of armour, and brought forth before the people; one of the public ministers proclaiming before them, that, 'Hitherto, in memory of their father's merits, the commonwealth had educated those young men, but now dismissed them, so armed, to go forth and thank their country by imitating their fathers' examples.'"

It surely appears but reasonable that children, whose fathers had fell in defence of the state, should be provided for; and, indeed, it was a law of the Athenian legislator, *Solon*, that children, whose fathers had fallen in the defence of their country, should be maintained and educated at the public expense, and under the inspection of the state.

Diogenes Laertius informs us that the same thing was also established at Iasei, and likewise at an island on the coast of *Caria*, as *Heracledes*, in *de Politis*, (which publication is generally added to *Aristot. Politic.*) assures us.

At Rome, a great number of children were maintained at the public expense, who were called *pueri alimentarii*, and *puellæ alimentariæ*.²

We are assured that the Emperor *Trajan* was the first who formed large establishments of this kind, and the children maintained in them were called, from his family name, *pueri Ulpiani*. *Pliny* relates in his panegyric, that he had caused five thousand free children to be sought out and educated. A noble theme for a panegyrist, indeed, and worthy so great a man. It is conjectured, he suffered them to remain with their parents, and that those who were unable to educate them themselves, received a sum of money, or, perhaps, an annual allowance of corn. It is also thought, that orphans were put out to board at a certain sum. The Emperor might in this way have done a double benefit to humanity: first, by protecting the helpless, and next by augmenting the resources of families depressed by poverty, in making allowance for their children, thereby increasing the comfort of those families. To have a large family, therefore, under so wise and good a prince, was not a misfortune to the parents, but rather a blessing. We may say, without incurring the reproach of levity, that children were begotten

¹ *Diogen. Laert.* i. § 55. p. 34. See the observation of Menage on this passage, and Plato's commendation in *Menexenus*. Also of Demosthenes in *Adversus Macartatum*.

² Mention is also made of them many times in the Roman laws, L. 8. § 9. et § 24. D. de Transact. L. pen. § 1. D. ad leg. Falcid. See also *Ælii. Spart. Vita Adriani*, c. 7. p. 67. *Æl. Capitolin. Vita Antonini*. P. cap. 8. p. 266. *Vita Pertin.* c. 9. p. 555. *Æl. Lamprid. Vita Alexandri Severi*, c. 44. p. 995.

in order that parents might avail themselves of his beneficence; to support which, a large capital was not extracted from the public treasury; it all came from the privy purse of the Emperor. In order for these establishments to be perpetuated after his death, that money destined for their support was vested in lands, which produced a perpetual income. This, we are informed, is proved by a letter of foundation for the town of *Veleia*, still extant.

In 1747, some peasants whilst ploughing in the neighbourhood of *Placentia* found, together with several other antiquities, a copper plate, five and a half feet in height, and ten and a half in breadth, weighing about 600 pounds. They broke it in haste, expecting to discover treasure hid beneath it, but were disappointed; they sold the pieces as old copper. One of them happened to fall into the hands of a learned Italian, Count Giovanni Roncovieri: he remarked, that it contained a part of a public document belonging to the reign of the Emperor Trajan; with trouble and expense, he procured the whole of the pieces; thus saving one of the best explications of the hitherto disputed character of that prince, and not the least valuable of ancient documents; being a complete record respecting an imperial establishment for the community of *Veleia*. This inscription is formed of six hundred and seventy lines, divided into seven columns, over which stands the following title: “*Obligatio. prædiorum. ob. H—S. deciens. quadraginta. quatuor. milia. vt. ex. indulgentia. optimi maximique. principis. imp. Cæs. Nervæ. Trajani. Aug. Germanici. Dacici. pueri. puellæque. alimenta. accipiant. legitimi. n. CCXLV. in. singulos H—S. XVI. n. f. H—S. XLVII. XL. n. legitimæ. n. XXXIV. sing. H—S. XII. n. f. H—S. IV. DCCCXCVI. spurius I. H—S. CXLIV. spuria. I. H—S. CXX. summa. H—S. LIICC. quæ. sit vsura ⁂ ⁂ sortis. supra. scriptæ.*”

This inscription has been several times published; it may be found under the title of *Exemplar Tabulæ Trajanæ pro pueris et puellis Alimentariis reip. Veleiatium. cura et recensione A. F. Gorii. Florentiæ, 1749, five sheets in folio.* From whence it is learnt, that Trajan invested a capital of 1,044,000 sesterces at five per cent. interest, on forty-six farms around *Veleia*, which community was meant to be benefited by its establishment. These farms formed for the mortgage a security, and are particularly named, together with the sum secured on each estate. The annual interest amounted to 52,200 sesterces. Of this sum 245 boys, born in wedlock, received monthly sixteen sesterces each, which

amounts to the annual sum of 47,040 ; and thirty-four girls of the same description, twelve sesterces monthly, amounting annually to 4896 sesterces. Besides this, one illegitimate male child received yearly 144 sesterces, and one illegitimate female child 120 sesterces. These various sums amounting to the exact complement of the interest so secured.

This sum may be reduced to modern pounds, shillings, and pence, on our understanding that the value of a Roman sesterce was about one shilling and three pence three farthings of our money ; but the relative value of this coin to our currency cannot be so exactly determined, because we are not so fully acquainted with the value of the necessities of life, which must in every country, and in every period, fix the value of the circulating medium. However, it should from the previous statement be observed, that the ratio of interest for money did not then differ very materially from what is now its legal standard in Britain.

It is said, the favourable state of public morals in the period of Trajan, may be inferred from his providing for only two illegitimate children among 300 ; this circumstance we do not presume to judge upon.

We should also notice, that it appears it was customary to make these eleemosynary payments monthly, which is another favourable trait, we conceive, in favour of the morals of that period : for, admitting the actual necessity of such regulations in the present case, we may also infer, that other transactions among the people were managed with similar propriety.

We understand from a passage in *Dionysius of Halicarnassus*, that the same was the case when money was bequeathed in perpetuity for benevolent purposes by any last testament. His words are Τον δημοσιως δίδομενον σιτον λαμβανοντες κατα μηννα, Frumentum menstruum e publico accipientes. Lib. iv. p. 228. edit. Francof. 1586. fol. Whence we may also conclude the same regulation was observed with respect to the distribution of corn.

It is, we understand, an opinion of *Muratori*, one of the commentators upon the previously mentioned inscription, that these pensions were paid to the boys until they had attained the age of eighteen, and to the girls until they arrived at fourteen ; at which period the males were considered proper for either public service in the army, or were sufficiently strong to earn their subsistence ; and the girls also, being considered marriageable, or fit to take any employ suitable to their strength. It is certainly probable, as *Pliny* also

suggests, that Trajan in his benevolent establishment had also an eye upon those lads to furnish recruits for his army. This is extremely likely, and does not detract in the slightest degree, from his benevolent intentions.

The munificence of Trajan also furnished an example for opulent individuals to pursue the same track his luminous mind had chalked out; accordingly the same plate perpetuates the bequest of one *Cornelius*, who gave 3600 sesterces, being the interest of 72,000 sesterces, to be employed in maintaining eighteen legitimate males, and one legitimate female child, at the rate before mentioned. Pliny also followed these illustrious examples, and founded from his own property pensions for the maintenance of poor children; this is confirmed by an inscription still extant. He also mentions the same circumstance in his letters. *Antoninus Pius* also made an establishment for poor girls, who, after his consort, were called *puellæ Faustinianæ*, as did also *Antoninus Philosophus* the same, from the name of the Empress called *Faustinianæ*; and by way of distinction from those of Antoninus Pius, *novæ puellæ Faustinianæ*. Alexander Severus formed an institution for boys and girls, whom he named after his mother *mammæani* and *mammæanæ*.

The superior management of these establishments is believed to have been intrusted to great public functionaries in each of the provinces where they were made. It is known that in each of the Italian states in the Roman provinces, there was an officer of rank, who besides his other titles, was called *procurator ad alimenta*. That this office was of the first distinction is proved by the circumstance that the Emperor *Pertinax*, whilst young, held it in the towns and villages on the *Via Ancilia*, and in his latter years, in Rome itself. *Didius Julianus*, also, before he became Emperor, after having filled the honourable offices of *prætor* and *cōsul*, the next to the imperial dignity, and after he had been governor of Germany, was therewith invested.

It has been observed, that the first time the word orphan-house occurs, is in the laws of the Emperor Justinian, under the name of *orphanotrophium*; at later periods they often occur by name.

In the court of Constantine, and his successors at Byzantium, the office of inspector of orphans was denominated *orphanotrophi*, and there it was considered so honourable, that it was held by the brother of the Emperor Michael IV. (Paphlago,) in the beginning of the eleventh century.

We much regret, that if there were similar establishments

in the middle ages and latter times, which we should hope in most European nations was the case, but that we possess no records of them. At the time we lament the paucity of such benevolent endowments in former ages, we must congratulate our species, and particularly our own country, that of late years the spirit of pure disinterested benevolence has manifested itself in this island in a very great degree; we have many similar establishments under various denominations: there is, in particular, one in the *City-road*, which is placed under the superintendence and direction of the Corporation of London. We have also an establishment called *The Refuge for the Destitute*, under the direction of gentlemen of the first respectability. This appears to be the extreme of all charitable foundations; for most known cases, there are specific charities; but this comprehends all which may be placed out of the nominal pale.

PAPER.

Before the invention of paper, in ancient times, a great variety of substances have been used for the purpose of recording events, or delineating ideas, of which it becomes our duty to render some satisfactory account. Although much might be said upon the utility of paper, we forbear, because it must be sufficiently apparent to the conviction of every understanding.

It is said, that rough stones and stakes were used as the first known records of the ancient Phoenicians, remains of which are reported to be still visible; and to confirm this persuasion, certain heaps of stones have been discovered in the environs of *Cadiz*, which are currently believed to be the remains of those monuments alleged to be made by Hercules, in memory of his famous expedition to the gardens of the Hesperides for the golden fruit, or as others have it, against Spain. It is also stated, that the usual mode of recording great events in the north of Asia and Europe, was by placing stones of extraordinary size; in aid of this, we have a great variety of instances in Strahlenberg's historiographical description of those parts. And it is also reported that this is the mode which the Americans practised: some placing bows upon the tombs of men, and a mortar with a pestle upon those of the women. It has also been customary to give names to places and their environs, which are said to have reference to memorable events there transacted. Of the chief of these circum-

stances, we observe various passages in scriptural history which offer proof that such was the ancient custom among the primitive patriarchs of mankind.

Since the *scriptural* art has been introduced, or invented, many materials have been, in a variety of ages and in numerous countries, used for the purpose of recording events to posterity. Let us endeavour to ascertain the chief of those substances, and approach as near as we can to the period of their original use. With regard to the former portion of our inquiry, we may, perhaps, find that certain *names* may assist us, and we suppose the evidence of writers may not be entirely wanting with respect to the latter consideration.

In various parts of Siberia, Strahlenberg saw several rocks inscribed. He particularly describes such materials when he mentions characters he found in Siberia. His observations are too long to give them entire, so we subjoin the following extracts:

“CHARACTERS.—Chymists, astronomers, and mathematicians have their peculiar characters; but this word likewise denotes such a kind of writing which none can understand but he that hath the key to it; and besides this, a certain sort of figures carved on stone, or engraven on metal, or written on parchment, or otherwise, which are pretended to have a secret signification, and are used in magic and other superstitious ceremonies, are called characters. Of this latter sort are many found in Siberia and Tartary, upon rocks and stones, either carved or painted in the same manner almost as the Laplanders are wont to paint their drums. There are some,” he says, “in *Great Permia*, near the city of *Tzerdyn*, which are either burnt in or written by other means upon the rocks there, with red indelible colour, perhaps after the same manner as formerly in *Iceland*; they used to write upon the bones of animals and fish the same sort of figures as described in another place. He saw similar figures cut or carved in rocks, on the banks of the river *Tomm*, between the cities of *Tomskoi* and *Kutsnetskoi*. But the figures here are likewise painted, or stained with a red colour, as I have said in tab. vii. which were found in the further part of *Siberia*, between the cities of *Crasnoyahr* and *Abakan*, upon the rocks on the banks of the river *Jenisei*; with this the reader may compare what *Matt. Belius*, (*de Vet. Lit. Hunn. Scyth.* p. 15.) mentions of these characters, and considering that the river *Jenisei* runs close under those rocks, which in some places are smooth and steep like a

wall, and as high as a steeple, it is hard to conceive how these painters, or other artificers, could come at them to make those figures, which are mostly in the middle of the flat surface of these rocks. They could not do it in summer by means of ladders, because the river in those places is deeper than the rocks are high; and in winter the snow which lies there above a man's height, and the terrible frost, would not allow them to climb up and paint them at all. There is, therefore, room to conjecture, they either found ways to let themselves down from above, or climb up from below by means of some wedges driven into the rocks." He afterwards confirms the possibility of this, by alluding to, and citing passages from *Le Croix's Histoire de Timur Beck*, tom. ii. cap. lviii. &c.; and adds, that he himself had seen many of those wedges.

As we have formerly seen, and just shown, it was the practice to write upon rocks, &c. which circumstance we have previously noticed to be mentioned by the author of the book of Job; and we have previously recognised that passage in Josephus which mentions the pillars of Seth. The mention of these pillars revives in our recollection those of Bacchus, Hercules, Osiris, Sesostris, and others, to commemorate their exploits; also the famous pillars of Mercury Trismegistus, in hieroglyphics; those mentioned by Porphyrius in Crete, containing the formula of the service of Cybele; that mentioned by Demosthenes, as standing in his time, on which the Athenian code of legislation was engraven; the famous Sigean stone; the previously given Parian chronicle; also the famous Rosetta triple inscription, and innumerable other Egyptian records upon similar materials, furnish adequate and incontrovertible proof of the truth of this assertion. We need not mention the inscription in the royal palace of Darius, or of the forty pillars in the Persepolitan character. Likewise the instance mentioned by *Diodorus Siculus*, of those paintings on the unburnt clay, afterwards burnt in enamel: likewise noticed by the Indian antiquary.* The ancient monuments of Chinese knowledge, are said to have been engraven upon large stones. The Hebrew commandments were written upon marble plates, as we are informed; and it is said Joshua also wrote the other laws upon the same material. The names of the twelve tribes were engraven upon precious stones, set in the ephod of the high priest.

* Vide his *Dissertation on Babylon*.

The *jus publicum* of the Athenians, was engraved on triangular stones, named *cyrbes*. Numerous old inscriptions in the Etruscan, Greek, and Latin languages, on sarcophagi, &c. are preserved in the Tuscan gallery at Florence. We have also, in the course of our inquiries, seen the application of impressing inscriptions upon humid bricks, witness those of Babylon in the British Museum.

Subsequent to these modes of record, leaden plates were chosen. Pausanias relates that Hesiod's *Opera et Dies* was written upon this substance. Pliny assures us that lead was used for writing, rolled up like a cylinder. Hertius wrote to Decius Brutus on leaden tables. In Italy were preserved two documents of Pope Leo III. and Luitbrand, king of the Longobards; and, according to Kircher's museum, tab. x. many more of such writings on lead are to be found. Montfaucon takes notice of a very ancient book of eight leaden leaves, the first and last serving for a cover, containing numerous mysterious figures of the *Basilidians*, and words partly Greek and partly Etruscan characters; on the back were rings, fastened to a small leaden rod, which held them together. In the *British Museum* there are two ingots, or, as called, pigs of lead; one inscribed with the name of the "*Emperor Domitian*," weighing 154 pounds, discovered in the year 1731, under the ground, on *Hayshaw Moor*, in the manor of *Dacre*, West Riding of Yorkshire; No. 4, room 7, Gallery of Antiquities. The other with the name of "*L. Aruconius Verecundus*," weighing 81 pounds, found near Matlock Bath, in Derbyshire; No. 5, room 7, Gallery of Antiquities.

Bronze, however, it appears, was more frequently used than lead for records, as is certified in the history of the Maccabees, by Dionysius of Halicarnassus, Cicero, Livy, Pliny, Suetonius, and Julius Obsequens. Phœnician letters were engraved on a kettle of bronze, devoted by Cadmus to Minerva, who was adored at Lindus, in Rhodes. The kettle with its letters, and those tripods with Cadmæan letters, mentioned by Herodotus, are not to be now found. The famous *Scriptum de Bacchanalibus*, in the Imperial Library; Trajan's *Tabula Alimentaria*; and the helmet found at *Cannæ*, with Punic letters, described by Gori, now in the third room of the Tuscan Gallery. Eight bronze tables were found in the town of Gubbio, in a subterranean cabinet, anno 1444, when part of an amphitheatre was removed: seven of these bronze tables are in Latin, and one in the Etruscan language. Many bronze tables have, we understand, been dug up in Tuscany. The seven former mentioned tables in Latin,

have been described by Merula, Gruter, and others; and the other by Thomas Demster. The civil, criminal, and ceremonial laws of the Greeks, were engraven on bronze tables, as was the speech of Claudius on plates of the same metal, and are still preserved in the Town Hall of Lyons.

The celebrated laws of the twelve tables, it appears, were first written on oak; afterwards, it should seem, according to custom, they were transcribed upon ivory tablets, and hung up *pro rostris*, after they had been approved by the people they were engraven on bronze. These, with others, were all melted from lightning having set the capitol on fire, which Augustus much lamented. The laws of the Cretans were likewise engraved on bronze. The Romans it will appear, generally *etched* their *codex plebiscita*, contracts, conventions, and public records in *brass*, as well during the existence of the republic as in the time of the emperors. The Athenian magistrates were chosen by lot: their names were engraven on bronze plates, and put in the urn with white and black beans; we need not observe the names drawn out with a white bean were duly elected.

The pacts between the Romans, Spartans, and Jews, were written on brass, which method was also observed by the Guilds, as well as in compacts between private persons, who likewise got the land-marks of their estates written on metal. In many collections are yet preserved discharges of soldiers on *copper*.

We have already seen the *Tabula Alimentaria* of Trajan, at Veleia, was written upon this metal. Not long since, it is asserted, a copper-plate was dug up at Mongheer, in Bengal, on which, characters of Sanscrit were etched, signifying a gift of land from Bideram Gunt to one of his subjects. This bill of feoffment on copper, we are told, is dated 100 years before the Christian æra, and proves that at that time, 2000 years ago, the Indians were highly civilized. Such instances in more modern times are very rare. Though Adelbert, Archbishop of Mentz, ordered a grant to be engraved on metal plates, which are kept over the door-wings of the church of *B. Mariæ Virginis ad Gradus*, in Mentz. In 1011, those door-wings were afterwards cast in metal, to resemble the bronze, by order of Archbishop Willigis.

The abbot Cabent, and Benedictine monk Legipont, were of opinion that the most ancient material for writing was *wood*; and notwithstanding what we have seen, we admit that both box, oak, and ivory have been occasionally employed in very ancient days. But it should seem much depended, with

regard to material upon the *nature* of the instrument, and also upon the dignity of the parties; as we have seen, public acts were written upon the most durable material, bronze: such which were not of so much import, were occasionally executed on perishable substances. Most public acts of princes and great men, except, indeed, the previously mentioned *Tabula Alimentaria* of Trajan, at Veleia, were written upon bronze, but this seems to have been done on copper, if our previous information be correct.²

In *Isaiah*, xxx. 8, and *Habakkuk*, ii. 2, mention is made of writing on a table, that it may be remembered in time to come, for ever, and for ever. This may be only figuratively given, as the accompanying expression appears to be strong and hyperbolically conveyed.

Solon's civil laws were written upon boards, and placed on a machine constructed to turn them easily, called *axones*; this was only, perhaps, because they were rather voluminous; and we have seen the twelve tables were so originally written till those public laws had received the approving sanction of the people, when they appeared in bronze. Even in the fourth century the laws of the Roman emperors were written upon boards painted with ceruse; whence Horace, is said, takes the occasion thus to express himself; "*Leges incidere ligno.*" This, however, we should suspect could not have given the poet occasion to have used that expression; because, if our memory serve us, Horace was contemporary with Augustus. The Swedes had a similar custom, whence their laws are called *balker*, from *balken*, a piece of timber, a balk, or beam.

The ancient Greeks and Romans commonly, and at a very early period, wrote upon plain wooden boards, not covered with wax, called *schedæ*, or *schedulæ*. On such *schedula* was written in Hebrew, the *Gospel of St. Matthew*; which, according to Baronius, in his *Martyrologio Romano*, was found in the tomb of Barnabas. Those overlaid with wax were named *pugillares cerei*. Persons desirous of secret correspondence first wrote on the wood, and then covered it with wax. Pliny says, the custom of writing on boards was introduced before the Trojan war. It was also customary to name such boards *cera*, whence comes *cera prima*, *secunda*, &c. The ancient jurists often wrote the words *tabula* and *cerae* in union. It should, however, appear, that under the word *tabulis*, was implied a carefully written work;

² Vide the last article, *Orphan Houses*.

and under *ceris* and *pugillaribus*, they understood a careless written manuscript, or copy. Attention should be paid to the words, not only to distinguish them from mere wooden boards, but also to know when stones, ivory, and metal plates were used, all having the same generic nomination.

The Romans employed for common use, chiefly for *letters*, small boards, overlaid with bees' wax; if for general purposes, they were fastened together with tape or string; if for letters, they were covered with linen cloth. Martial calls such *tenuēs tabellas*, which were not overlaid with wax, but in which the letters were carved.

There is a record of wood covered with bees' wax in the Town Hall of Hanover, consisting of a local schedule belonging to some legal instrument, containing the names of proprietors of houses in that town. In the library of Geneva there is, we are told, a manuscript of the same material.

The opulent among the Romans, used thin pieces of ivory, called *libri eborci*, or *libri elephantini*; and Ulpian states that the principal transactions of great princes have been usually written with a black colour on ivory. Flavius Vopiscus says, there was a book of ivory in the library of Ulpian. Martial, Salmasius, and Schwarz, might be also cited, to prove the existence of such materials for this purpose. Those tablets were, however, too valuable to be used by common people. It should have been noticed, that on boards overlaid with wax, of various sizes, as Quintilian says, beginners in writing first learnt; and Cicero also alleges, that upon these kind of manuscripts, critics read the works of others, and pointed out errors in construction, &c. with *red* wax, which they laid upon the other. The Greeks and Romans continued the use of those wax manuscripts even after the more convenient materials of Egyptian paper and Pergamian parchment had been introduced, for the sake of correcting what they had written. Hence it was of most extensive utility to register fugitive ideas.

The Chinese have, in ancient times, written with strong iron tools upon pieces of bamboo, and occasionally on metal. In Europe, it seems, palm-leaves succeeded to boards, as a material on which to write. We have seen the expressions of Aristophanes and Callimachus upon this question, in a previous article. Pliny, we understand, states that the Egyptians first wrote upon palm-leaves, and called the practice *Phœnician*; they also called the palm-tree *phœnix*. In the city library of Stralsund, a book is still to be seen, written on palm-leaves; which practice is still continued

among the natives of Malabar, as described in *Corypha umbra culifera*, who form their letters with a fescue twelve inches long, and smear the leaves afterwards with oil.

There is a Bible still preserved, written on this material, in the library of the University of Gottingen, containing 5376 leaves, formed into 45 sheets. Another Bible of the same material is at Copenhagen, and part of a New Testament in Malabaric, in Hesselberg's library; a third in the Orphan's House at Halle. A Brahmin MS. on the same substance, in the Kulingiennian language, is in the University of Oxford. Mr. Astle states, in his *Origin and Progress of Writing*, c. iv. p. 49, that there were in Sir Hans Sloane's collection more than twenty manuscripts in various Asiatic languages on the same material; and that himself possessed a Peguan MS. 21 inches long, by $3\frac{1}{2}$ wide; the ground richly ornamented with gold, and the letters inlaid with a black gummy substance.

Knox, in his *History of Ceylon* states, that there is a species of palm-tree, of which the leaves are woolly, of considerable breadth, named the panaga tree, used by the inhabitants for writing, after the outer skin is taken off.

The sentence of banishment (*petalismus*) of the Syracusans was written on olive leaves, as was the expulsion from the Athenian senate, called *ekphillophoresis*, written on the same material. The inhabitants of the Maldive islands write on leaves of the macarcquo tree, which are three fathoms long, and one foot wide, and sometimes on thin wooden boards, after being painted white. Also in many parts of the East Indies, leaves of the musa or banana tree were used for writing till the Europeans introduced paper. In the isle of Java, however, the ancient material is still used; leaves of the lanter tree, very smooth, and five or six feet long. Several other substances are used by the inhabitants of those parts; as leaves of the cocoa, taon-conder, Malayan olen, growing every where, about $1\frac{1}{2}$ yard long, 3 inches wide; for extensive writings, tied together. The letters are written with an iron tool: however those leaves are preferred to our paper, because wet or damp situations does them no injury. It has been remarked, that poplar leaves were principally used for sacred purposes, whence Pythagoras is said to have called it *the sacred leaf*. To leaves of trees, succeeded the BARK of the alder, elm, and birch, the outer rind *cortex*, and the interior *liber*: hence the origin of the Latin name for a book may be perceived. To render these portable, they were rolled up and carried in *volumen*; which names rolls have still retained. The name

codex, or perhaps *caudex*, still in use, designates a trunk of a tree; many of such barks in a mass, were thought to have some resemblance thereto. The shape of the bark on which Europeans wrote, the inner kind being only used for that purpose, was in different parts various. Montfaucon says, there are none of these manuscripts in Italy, and only one in the archives of St. *Denis*. Cragus saw at Chur, in Switzerland, some verses of Virgil, on the interior bark of the birch. It appears by the *Acta Petropolitana*, tom. x. p. 449, that many whole books of this kind have been found in Siberia, written in the Kalmucian character. The ancient favourite song, *Eija mit hierta ratt innerlig*, was called the birch song; because Elsa, the daughter of Andres, had originally written it on the bark of a birch tree. Respecting Siberia, we should have noticed that, on the authority of Von Strahlenberg, we have to assert that golden plates, of large dimensions, have been discovered in the tombs of the ancient Tartarian princes, with inscriptions upon them.

The protocols of the Emperors in early times were written upon delicate bark to prevent falsifying; because if the substance was shaved in the least degree, the letters were destroyed and could not be replaced. Many nations are said now to use it. Von Justi says, he possesses a letter, written in Malabaric upon the bark of a tree. The same material for the purpose is found in the Orphan-house at Halle, in Saxony. In the late Sir Hans Sloane's library, is a letter of a nabob, two yards long, ornamented with gold. In the British Museum are many specimens of this substance; also in the Grand Duke's gallery at Florence. In the Vatican library are MSS. in Greek, Hebrew, Arabic, and Latin, upon this kind of substance.

To this mode, is thought to have succeeded the practice of painting letters on linen and cotton: what was the difference in preparation of that material to the one now employed is not ascertained; but it is thought some preparation was necessary in order to use the substance. According to Symmachius, the predictions of the Sibyls were written on linen cloth. Livy states the same of the diurnal registers of the Romans. Pliny says, linen was only used for private affairs; Livy and Claudian assert the contrary: and in the Theodosian Code, lib. xxvii. cap. II, is mentioned a law written on *mappas linteas*. Count Caylus says, there have been found, in the chests or cases containing Egyptian mummies, very neat characters written on linen. The inhabitants of Parthia are said to have written on the same stuff of which they made their clothes. Some Indians still use a cloth they

call *syndon*. Linen being subject to accidents from becoming mouldy, &c. asbestos cloth had been occasionally used in small quantities, there is occasion to believe; also since the art of paper manufacture has been introduced, a paper has been made from that mineral, which is incombustible.

The accidents to which these species of materials were most of them subject, and linen particularly so, induced man to endeavour to remedy those defects: he accordingly is found to have recourse to the animal creation.

In the convent of Dominican monks at Bologna, are two books of Esdras, written on asses' skins, said to have been written by Esdras himself; but from circumstances attending them, they are thought to be not above 500 years old. These were given to the Prior Aymerico by a Jew, in the beginning of the fourteenth century; in appearance something like tanned leather. The ancient Persians and Ionians wrote on hides from which the hair was scraped. The shepherds wrote their songs and odes with thorns upon straps of leather, which they wound round their crooks.

The ancient Welch had a most peculiar manner of writing, upon small squared oblong pieces of wood, which they called *billetts*, which name forms the appellative to numerous of their productions, as "The Billett of the Bards."

The Icelanders scratched their *runes*, a kind of figurative writing, on walls: it is noticed in the *Laxdaela Saga*, that Olof, at Hiardarkult, has built a large house, on the balks and spars of which he got engraved the history of his own and more ancient times: and Thorkil Hake wrote his own deeds in those hieroglyphics on his chair and bed. The most ancient *runes* are traced to the third century, and the oldest historian who mentions them is Venantius Fortunatus, who lived in the sixth century. Of these letters or hieroglyphics, there were no more than sixteen; but in the year 1000, the Christian faith was introduced into Iceland, when these were found insufficient, and Latin letters were adopted.

Puricelli states, that the Italian Kings, Hugo and Lotharis, had given a grant to the Ambrosian church at Milan, written on the skin of a fish.

Not only the skins of animals were used for this purpose, but also entrails and bones. In the history of Mahomet, it is signified that the Arabians recorded remarkable transactions upon the shoulder bones of sheep, which they cut with a knife, afterwards tied them together, and hung up those chronicles in their cabinets.

In the Alexandrian library, there were the works of

Homer, written in golden letters on the skins of animals. In the reign of the Emperor Basiliskus, was burned at Constantinople a MS. 120 feet long, written on the intestines of beasts, in golden letters, containing the Iliad and Odyssey of Homer. In the library of the Emperor Zeno Isauricus, were likewise Homer's works, painted in golden letters on animal intestines. And it is well ascertained that the intestines of elephants have been used for writing.

It is conjectured these last mentioned materials were never in general use, but were regarded as a great rarity. In his Britannic Majesty's library at Hanover, there is a golden plate, written by an independent prince of Coromandel to King George II. 3 feet long and 4 inches wide, inlaid on both sides with diamonds.

At last we have arrived at the period for the introduction of the Egyptian *papyrus*, a kind of rush of large dimensions, growing in the marshes on the banks of the Nile, called in the native language *berd*, or *al berdi*. Theophrastus, Pliny, Prosper Alpin, and others, describe this plant as growing in swamps to the height of 10 cubits; the stalk triangular, of a thickness to be spanned, surrounded near the root by short leaves; stalk naked; has on the top a bush nearly resembling the head with hairs, or long thin straight fibres; root brown. After Pliny, Guilandin is said to furnish the best description of its preparation.

There is said to be a similar plant growing on the Euphrates, and of the like name; and also an imitation of both, Sicily is said to produce, called the *papero plant*. Modern travellers have said the Egyptian plant does not now exist.

The Egyptian *papyrus* was manufactured into paper from very fine pellicles near its pith, separated by a pin or pointed muscle shell, spread on a table in such form as was required, sprinkled with Nile water; on the first layer a second was laid crosswise to finish the sheet, (*plagula*,) then pressed, hung up to dry, afterwards polished with a tooth. The Nile water was very carefully used to prevent spots. Twenty skins were the utmost which could be procured from one plant. Those nearest the pith made the finest paper. Twenty sheets glued together were called *scapus*, but sometimes several scapi went to form a large *volumen*. This part of the business was executed by the *glutinatoris*, who resembled our bookbinders: all the workmen had proper names according to their work.

This plant yielded materials for making four sorts of paper.

The first called *Charta Hieratica*,—not cleaned at all.

Charta Augusta had one cleaning.

Charta Lavinia, rendered superior, by a second cleaning.

Charta Hieratica was also a name given to it in its greatest degree of perfection.

Those names we see are all Roman, and the second and third sort had their names in compliment to the Emperor and Empress.

The Romans subsequently improved those papers, and from four sorts made eight, by adding more sheets to the substance, and varying the sizes.

1. The *Charta Hieratica* was eleven inches wide.

2. The *Charta Claudia* was an addition in thickness to the *Charta Augusta*.

3. *Charta Fannia*, ten inches wide. 4. *Charta Amphitheatrica*, nine ditto. 5. *Charta Saitica*. 6. *Charta Tانيتica*. 7. *Charta Emporetica*, of various dimensions, and *Charta Macrocolla*, the largest.

With respect to other substances for the same purpose, there are many, but as most of these have one generic character, being manufactured from the bark of trees. The detail is not given, as it might not be, perhaps, generally interesting, and as nothing new appears in this respect, except what the travellers in the north say of a paper, whose texture very nearly resembles our modern paper; only that from its feel, it appeared to be made from *cotton* alone, at a very early period, and brought from China, as it has been believed, to Tartary, where it was seen by *Von Strahlenberg*, impressed with blue and green letters.

Should it be, indeed, true, that paper-books, rolls, or volumens, were discovered in a tomb, presumed to have been that of NUMA, as *Cassius Hermias* asserts, the art of manufacturing paper must, of course, have existed, probably, before his days, or at all events before his death, which will carry the origin of the art as remote into time as about 700 years before Christ, he dying 716 years before the Christian era. But this paper, if such records were discovered, must certainly have been composed from the innermost pellicles of the *papyrus*, which were admirably delicate, and after manufacture, nearly as thin as India paper. The species of Egyptian paper called subsequently *lavinia*, with two or more skins of it stuck together, might have been thus preserved, as those records are described to have been.

With respect to the paper now in use, Dr. *Blair* says, the first paper-mill (in England, we suppose) was erected at Dart-

ford, in the year 1588, by a German of the name of *Spiellman*; from which period we may, perhaps, date the manufacture of it in this country.

It appears, however, from what has preceded, that it was known in the East much earlier, it being observed that most of the ancient manuscripts in Arabic and other oriental languages were written upon cotton paper, and it is thought the Saracens first introduced it into Spain.

Anderson, in his *History of Commerce*, vol. ii. p. 197, says, that till about the year 1690, there was scarcely any good paper made in England, but the coarse brown sort. Paper was previously imported from France, Genoa, and Holland. However, the improvement of this article in this country, in consequence of the French war, produced a saving to Britain of £100,000 annually, which had been paid to France for paper alone.

After linen is so much worn as to serve no other purpose, the several species are collected together, and the hard seams and other accumulations, which would require a much longer time to prepare proper for the general mass than would be consistent with the economy of the whole, those shreds are then separated and thrown away; the different kinds are then collected together and kept separate from each other. In such a state of separation they are laid in troughs, which are afterwards filled with water, where they are suffered to remain till a species of fermentation takes place; and the separation of the parts formed by art is not only rendered easy, but also a division may be made of the most minute parts; the separation is then made by machinery. When properly prepared, a sufficient quantity is placed upon a wire frame, or otherwise one formed of cloth: by mechanical pressure the moisture is extracted, after which the sheets are hung up separate upon lines to dry, in a building properly constructed to admit a free circulation of air.

Manufacturers of paper, originally could only use white linen rags to make white paper; but Mr. Campbell, in 1792, discovered a method of discharging any colour from rags, by bleaching with *oxymuriatic acid gas*, for which he obtained a patent.

The next considerable improvement which appears to have been made in the manufacture of paper consists in using felt or woollen cloth in conjunction with the wire-cloth previously used, and also now of necessity retained, and other processes too voluminous to be inserted in this article.—Vide article PAPER in *Rees's Encyclopædia*.

The only remaining circumstance we have to mention is, that in the beginning of the present century there was manufactured, in the vicinity of the British metropolis, a very good paper used for printing, and made entirely from *wheat straw*; for which manufacture the inventor obtained a patent; but he did not succeed, we presume, because it is now discontinued.

PAPER-HANGING.

The desire of man for the gratification of natural wants being soon satisfied, he yet is wanting; those artificial *stimuli* which arise in the mind, and are the source of his comforts, because their gratification yields him high delight. Having built a house, to shelter himself from the exigencies of weather, to enlarge the sphere of his pleasures, he is desirous to ornament it; and because he cannot, perhaps, construct his house of silver, gold, or costly stones, he says I will, at least, have an imitation of one of these, and he drops upon gilding, lacquering, painting, and staining. This idea we will presume to have given origin to every species of decorative ornament in the construction of houses.

The ancient Greeks, according to Archbishop Potter, constructed not only their arms, but also their houses, occasionally of brass; whilst the Romans, according to a passage of *Seneca*, before given, frequently gilt theirs. They often, as we have also seen, covered them with costly casings or veneers; sometimes with very precious stones on the outside. *Vitruvius* and *Pliny* speak of amethyst, jasper, cornelian, and other valuable stones, being employed in covering certain palaces; *Heliogabalus paved* the Palatine mount with foreign marble; others, equally extravagant, had even lapis lazuli steps. Therefore, since they went to those great costs to ornament the outside of their habitations, we need not wonder at what they endeavoured to effect within. It is true, that they spared no expense in this respect, as a variety of instances we have before seen, will tend to convince us. Those people, however, who could not procure these extravagancies in reality, thought they would have, at least, an imitation of them, accordingly they had recourse sometimes to veneers of those substances they had seen substantially employed, by the rich and luxurious, as well for outside ornament as interior decoration; those who could not afford this, had recourse to pigments and the graphic art; for this purpose the ingenuity of man was em-

ployed to devise various modes of ornament and decoration. Hence arose the practice of various kinds of painting, the *fresco*, *scagliolo*, &c. and lastly came staining of paper in use.

To enumerate the various kinds of this might be attended with very little benefit, because the *principle* of all is nearly the same. However, it has been noticed by a contemporary author, that of these he thinks three kinds are deserving of attention. The first and plainest is that which has on it figures, drawn and painted with one or more colours, consisting only of painted paper. The second contains a woolly stuff, dyed of various tints, and made to adhere to the paper in certain forms by a glutinous matter; and the third, he says, is a species of paper covered with metallic dust. There are other papers used for hangings, which contain a representation of many species of stones, of which, we understand, a Mr. Breitkopf, of Leipsic, is a large manufacturer.

There is also a species of velvet paper,—a paper covered with sham plush, or wool dyed and cut short, and made to adhere to the paper by some gluten or cement, said to have been the invention of an Englishman, of the name of Jerome Lanyer, in the reign of Charles I. On the 1st of May, 1634, he received a patent for his art. In the specification, it is stated, that he had found out an art and mystery, by affixing of wool, silk, and other materials upon linen, cotton, leather, and other substances, with oil, size, and other cements, to make them useful and serviceable for hanging and other occasions; which he called *Londrindiana*, and, he said, it was his own invention, and not formerly used by any within this realm.¹

However, it appears, that this invention of Lanyer was afterwards disputed by Tierce, a Frenchman, being said to have been the production of a countryman of his, named *François*, who, he states, had made such before 1620, and supports his assertion by producing patterns and the wooden blocks, with which it was printed, with the dates inscribed upon them. The son of *François*, it appears, followed his father's business at Rouen for more than fifty years, where he died in 1748. Some of his workmen are stated to have left him and gone to the Netherlands, Germany, England, and other places, where they sold their art.

It appears that Nemeitz ascribes the invention of wax-

¹ *Fœdera*, tom. xix. London, 1732, p. 554. See also in Anderson's *History of Commerce*.

cloth hangings, with wool chopped and beat fine, to a Frenchman, named Audran, who, he says, in the beginning of the last century, was an excellent painter in arabesque and grotesque figures, and inspector of the palace of the Luxembourg at Paris, in which he had a manufactory for hangings of that kind. Mr. von Heinecken states, that a person of the name of Eccard invented the art of printing on paper-hangings gold and silver figures, and that he carried on a manufactory for such works.

It certainly does appear that the Germans cannot claim the privilege of invention here, but were behind their neighbours in this art.

One of the most ingenious of new improvements, is said to consist in the art of manufacturing paper-hangings, by affixing to the substance of paper metallic dust, commonly called *Nuremberg* dust, by which it acquires a representation of various costly metals in a state of fracture, varied with glittering particles of differently formed parts; and, receiving the light in every direction, produce certainly a novel effect, which is rich and beautiful, at the time it is obtained at little expense.

The *Nuremberg metallic dust* is said to have been the invention of an artist of that city, named *John Hautsch*, born in 1595, died in 1670; his descendants have continued to the present time its preparation. It is produced from filings of metals of several descriptions, washed well in a strong lixivious water, then being placed upon a sheet of copper, are put upon a strong fire, and continually stirred until the colour is altered. Those of tin acquire by this process every shade of gold colour, with its metallic lustre; those of copper, different shades of flame colour; those of iron or steel, a blue or violet; of tin and bismuth mixed, a white or blueish white colour. The dust tinged in this manner is then put through a flatting-mill, consisting of two rollers of the hardest steel, like those used by gold and silver wire-drawers, for the greater convenience a funnel is placed over them. French covered paper manufactured from this material, is called *papiers avec paillettes*. Its lustre is so durable, that it is said to continue unaltered even on the walls of sitting apartments. This metallic dust is an article of commerce, being exported from Germany.

As early as the seventeenth century, the miners of Silesia collected and sold, for various purposes, a material they call *glimmer*, being bright, shining particles of various metals, which those mines produce in great profusion; even the black, we are told, acquires a gold colour by being exposed

to a strong heat. This was manufactured by the holy sisters of *Reichenstein* into a variety of ornaments; with it they decorated images of their *agni Dei*, strewing over them a shining kind of *talc*. The silver-coloured glimmer has not, however, so great a brilliancy or variety as the Nuremberg metallic dust; for which purposes that article has a decided superiority.

For the various purposes to which these ornaments are to be applied, different adhesive substances should be used; in some cases glue would have the effect, to be first drawn over the substance; in others, a strong varnish, in which wax is dissolved; and for others, various kinds of gums, particularly gum *tragacanth*: afterwards the dust is sifted through a species of *drugget*.

Those substances being so covered, the dust may be put in a drudger or common pepper-castor, and applied by sifting it over the substance to be so covered. Different figures may be drawn with a pencil, and the box of dust shook over them, as far as the extent of the lines covered with glue, the dust will only fasten so far as it meets with what produces adhesion.

PAVING OF STREETS.

Besides lighting and watching in cities and communities, there is one more beneficial regulation of a good police that remains now to be noticed,—we allude to the paving of streets. An object so indispensably essential may have been conceived to have existed from the most early periods of civilization; this, however, upon inquiry, will be discovered not to have been the fact: we shall find that it was not until a comparatively late date this beneficial regulation was introduced,—yet several cities have been discovered to have been paved anterior to our present æra. Those, however, which are at present the ornament of modern Europe, if we except Rome, were, we understand, destitute of this benefit until the twelfth or thirteenth centuries. And, it must be confessed, that in Grecian and Roman authorities there is much oftener mention made of paved high-roads than of this accommodation being afforded to the inhabitants of cities.

There is, assuredly, ample room to conjecture that the first pavements were effected by opulent individuals before their respective houses, before the necessity was noticed by governments. Being thus gradually made, the circumstances might have escaped the attention of annalists and

historians, whereas, on the contrary, great roads being generally made at the expense of governments; such, for instance, as the four chief ways or streets made in England, the *Watling-street*, *Icineld-street*, *Fosse-way*, and *Erminage-street*, which were great military roads, for the purpose of communication between the chief parts of the island, constructed at an immense expense; such were also the *Via Appia*, the *Via Emilia*, and others on *Campania del Romana*: those roads being of so great consequence to the government, and being constructed chiefly for its convenience, likewise requiring such an union of physical strength for their construction, it is not extraordinary that they should attract the notice of historians, annalists, and others, and the period of their formation be accurately recorded. Such roads were very often, in some countries, retarded by the want of stones, and other necessary requisites for their construction. However, to obviate these inconveniences, the industry and ingenuity displayed in many countries, are incredible; among these may be reckoned the amazing roads constructed by *Semiramis*, of which *Diodorus Siculus*, *Strabo*, and *Polyæni* have left us record. Traders also found it their interest in those days, (as they have latterly discovered canals to be conducive to the transmission of commercial articles from one place to another,) to have good roads.

On the record of *Isidorus*, we are enabled to state, that the first account we have of paved cities was that *Carthage* was first paved, and that *Rome* soon followed its example.

Whether the Grecian cities were paved and lighted, we have not found on record, further than that at Thebes the streets were under the direction of telearchs, who had the care of keeping them in repair, and of cleaning them. This office, which they held in contempt, they conferred upon *Epaminondas*, in order to disgrace him; but, by his prudence and attention to the public good, he rendered it so respectable, that it was afterwards coveted as an honourable employment. That the streets of Thebes were paved, some therefore think, else, they inquire, how was it possible to clean them.¹ We do not doubt the circumstance, but at the same time must also confess the possibility of cleaning them, although it might not have been attended with much good.

¹ Valerius Max. lib. iii. cap. 7, and Plutarch, in *Reipublicæ Gerendæ Præcepta*, p. 811.

Admitting *Thebes* to have been paved, we think its convenience must have been so very obvious, that Athens, Sparta, and other cities would have been paved also; and when we reflect that the Greeks, and particularly the Athenians, visited most countries for the sake of their improvements, to render their own respectable, we are further confirmed in the belief that if one Grecian city was paved, the same improvement would not have been neglected by others, and especially Athens. Notwithstanding, in the days of Socrates, we conjecture the streets of Athens, or at least a part of them, were not paved, for we recollect a passage in the life of that philosopher, or else detailed in *Xenophon's Memorabilia*, where a circumstance is mentioned respecting a drove of swine, which Socrates avoided, but some of his friends met, who went another way, contrary to his admonition, but repented they did not take his advice, because the dirt made by the animals very much annoyed them.

Whether Jerusalem was paved, does not appear clear, because it is not recorded; we are only informed in the first book of *Kings*, vii. 12, that the fore court of the temple was paved. Also, after the temple had been rebuilt, in the reign of Agrippa, the Jews proposed to him, after the workmen had been discharged, whose number Josephus says was 1800, to employ them in paving the streets. Now we submit, that, in consequence of this proposition, the inference is by no means forced, or unnatural, should we conclude it had been paved previous to its destruction. Further, we read in the *Talmud*,² that the streets of Jerusalem were swept every day, which may imply a solid pavement. This was not the case, however, it is apprehended, with the streets of Rome under the reign of the first kings. In the year 188 after the abolition of monarchy, Appius Claudius being the censor, constructed the first highway, which still bears his name. This, we understand, was called, by way of eminence, the queen of roads.

The time when the streets of Rome were first paved, is very uncertain, because that passage in *Livy*,³ which refers to this circumstance, is extremely obscure, and will admit of several interpretations. It has been said that it may be proved from him that the streets were paved in the 578th year after the city was built. Besides the same authority

² Pesachim, fol. 71. Metzia, fol. 26. See J. E. Faber's *Archæologie der Hebräer*. Halle, 1773, 8vo. p. 340.

³ Livius, lib. xli. cap. 27.

has said, that the censor in the 584th year of the city, caused the streets to be paved from the oxen-market (*Forum Bovarium*) to the temple of Venus, and round the seats of the magistrates in the great circus; which might not have been necessary had they been paved but six years before. The information of the same historian that the ædiles, in the year 459, caused the streets to be paved from the temple of Mars to the Bovile, and from Capena gate to the temple of Mars, does not apply certainly in the present instance, because that temple, it is known, was erected without the city.

The extravagant Heliogabalus caused the streets round the palace, or on the Palatine mount, to be paved with foreign marble, as we are informed; this occurs in his life by *Æl. Lamprid. cap. 24.*

The inspection of the streets belonged to the ædiles; and, under certain circumstances, in more ancient times, to censors. In the course of time, however, particular officers, called *curatores viarum*, and on account of their number *quatuor viri viarum*, were appointed for that express purpose. Two brothers, *Publii Malleoli*, when *curule ædiles*, caused the *Mons Publicius* to be paved, so that carriages could pass from the street *Velia* to *Mount Aventine*.

That the streets of *Herculaneum* and *Pompeii*, were paved with lava, having deep ruts formed by wheels of carriages, leaving a raised footway on each side for passengers, is a circumstance which several modern travellers have remarked.

Of all modern cities that of Cordova was the first that was paved in Europe, about the year 850, when *Abdorrahan II.* the fourth Spanish caliph, made it the seat of his dominion. This prince is said to have known the value of the arts and sciences so much, as to have favoured trade, so that in his reign the country was generally in a flourishing condition. He also supplied that city with water, which he caused to be brought in leaden pipes; and erected a mosque and other public buildings.

Paris was not paved in the twelfth century; as Rigord, the physician and historian of Philip II. relates, that the King being at a window of his palace, on the banks of the Seine, and observing the carriages in passing to have thrown up the dirt very much, so as to cause a great stench, his majesty resolved to remedy it by having the streets paved; which was effected, notwithstanding the heavy expense had prevented his predecessors from doing it. Orders were accordingly issued for this purpose in the year 1184; and upon that occasion, it is said, the name of the city was

changed, which had before been called *Lutetia*, from its dirt, was now named *Paris* by that sovereign, who also first caused the wall to the cathedral to be built. *Mezeray* says, that Gerard de Poissy, then *intendant de finance*, expended 11,000 marks of silver in this undertaking. Also in 1285, it appears, that the city appropriated certain sums for the repairs, for in this year it was proposed to them to carry the pavement through the gate of St. Martin, when the citizens excused themselves by observing, that the funds assigned them were insufficient for that purpose. As late as 1614, many of the Parisian streets were not paved.

Other French cities which were opulent enough, soon followed the example of their capital. We find *Dijon*, which was then reckoned the most beautiful city in the kingdom, was paved as early as 1391, to which Philip the Bold, duke of Burgundy, the second husband of Margaret, heiress of Flanders and other parts of the Netherlands, contributed 2000 livres; and that in 1424, paviments were employed in all the streets. Historians remark, that after this salutary regulation, such dangerous diseases as spotted fever and other maladies became less frequent.

That *London* was not paved at the end of the eleventh century, all authors agree. As a proof of this, they relate that in 1090, when the church of St. Mary-le-Bow, in Cheapside, was under repair, the roof being off, four large beams or pillars, twenty-six feet in length, sank so deep into the ground, being blown down by the wind, that scarcely four feet of them appeared above the surface. The streets of London, *Howell* says, were not then paved, but consisted of soft earth. When it was first paved does not appear. However, it is presumed, that it was not all paved at one period, but gradually, as opulence increased. Several of the principal streets, as Holborn, for instance, part of which only is in the city, were paved for the first time in 1417. It is described in the royal order, that the highway named Holborn, in London, (*alta via regia in Holbourne, Londonia*) was so deep and miry, that many perils were thereby occasioned as well to the king's carriages passing that way as to those of his subjects; he therefore ordained two vessels, of twenty tons burden each, should be employed at his expense, for bringing stones for paving and mending the same. *Anderson's Hist. of Com.* i. p. 244. Other streets were paved under Henry VIII. In this order the streets are described as very foul, and full of pits and sloughs, very perilous, and noisome, as well for the king's subjects on horseback, as on foot and with carriages. *Anderson, ut*

supra, p. 370. Some streets in the suburbs were paved in 1544, 1571, and 1605; the great cattle market of Smithfield, was first paved in 1614; others have since been paved at various periods, so that now, as previously remarked, there cannot be a cleaner city of such vast extent and business, more commodious on the surface of the earth.

The magnificent Augsburg, in Germany, anciently a colony from Rome, had nearly the same beneficial regulations as its parent; accordingly it had at an early period large covered passages for the conveyance of filth, similar to the *cloacæ* at Rome. However the first mention we find of its pavement occurs in 1415, when *Hans Gwerlich*, a rich merchant, caused a foot-path to be made from his house to the oxen-market; this circumstance gave the origin for paving of that city. Berlin was first paved in 1679, and the following years. King-street in that city, before the houses, was paved in 1684. The square behind the cathedral in 1679.

Some centuries after the pavement of Paris, every citizen was obliged to keep the street in repair before his own house, and clean it at his own expense, as is expressly commanded in an order of Philip the Bold, anno 1285. The public, however, careless of beneficial regulations when attended with expense and trouble, they were neglected. To this cause is to be ascribed the offensive state of the streets of that city in 1348, when a law was first made for inflicting punishment on those who neglected this necessary duty. In 1388, the penalty was increased. The novelty, and dread of punishment, and the vigilance of the new inspectors, induced the inhabitants of two or three streets to maintain a dirt-cart, called *un tombereau*; the nobility and clergy, who are always desirous of immunities, and united to oppose beneficial public works, endeavoured to exempt themselves. The markets and public squares remained uncleansed, and became still more dirty, because those who lived in the neighbourhood threw filth into them privately in the night-time, to avoid the expense of removing it; till at length these places became so insupportable, that toymen who frequented them with their wares wished to abandon them. This caused the regulation which took place in 1399, that none should be exempt. This regulation, and another which had taken place in 1374, effectually removed the nuisance. The removing dirt became at length a trade, and contracts were made for that purpose. The dirt-carriers and paviours discovered their occupations very lucrative; in proportion as they discovered this, the more exorbitant were they in their demands. The price of their labour at length

was regulated by laws, the former in 1396, and the latter in 1501 formed a company and were obliged to subscribe to certain regulations. The city increasing in size and population, the cleaning of the streets became too expensive for the people, so that government was obliged to take care of it; this took place in 1609. They were cleaned in this manner till 1748, when the last contract amounted to 206,000 livres.

The Parisians had long been in the habit of dirtying the streets, by bringing out every kind of filth and there depositing it. The inhabitants also contributed by throwing every thing out of windows; this was strictly prohibited. They also suffered their swine to run about the streets, till at last the young king Philip was killed by a fall in consequence of one of these animals running between the legs of his horse; hence they were prohibited. On the 3d of October, 1131, swine were prohibited for the future having ingress into the streets; but this the obstreperous and proud priests of St. Anthony opposed, because, as they alleged, it was contrary to the respect due to their saint to prevent his swine having the liberty of going whither they pleased. It was therefore found necessary to allow these clerical pigs that exclusive privilege, on condition that they were to have a bell about their necks.

That cry which was necessary for the inhabitants to proclaim upon their throwing any thing into the streets was *Gare l'eau*, "Take care of the water;" this also ceased in 1395. But the same privilege was longer indulged to the Scotch, for as late as 1750, when people travelled Edinburgh in the night, they were compelled to take a guide with them, who cried as he went along the streets, *Haud your haunde*, i. e. "Hold your hand."

The most rigid vigilance was essential in the police of Paris to make that people reform in their filthy practices. They had not as yet any privies in or about their houses. It is not more strange than true that an especial order of government was essential to compel those convenient offices to be established. Those who may wonder at this, will be astonished when they are told that the royal residence of the Spanish monarch was without them, at the time the English circumnavigators found privies erected in the European manner among the inhabitants of New Zealand,—complete savages. But it seems that neither was Madrid the only royal residence without this convenience, there were no privies in Warsaw till within these few years.

We are also given to understand that in the Parisian code of laws, *Coûtume de Paris*, improved and confirmed in 1513,

it is expressly ordered "that every house should have a privy." This order was renewed in 1533, 1697; and even in 1700 there was found a necessity for rendering its non-compliance penal. The same order and same words are to be found in the *Coûtume de Mante, Etampes, Nivernois, Bourbonnois, Calais, Tournay, and Melun*. That issued for *Bourdeaux* is in 1585.³

The establishments for every description of cleanliness, took place in Germany, it seems, at a much earlier period than in France. St. Anthony, we are told, had no hogs in Berlin. Occasionally in Germany the duty of scavengers was assigned to Jews. We hope to be excused for mentioning circumstances which have not been thought to be beneath the historical pens of our predecessors.

PENS,

So long as wax tablets were in use, an instrument similar to a bodkin, or *stylus*, as previously mentioned, was used for the same purpose as that to which we now employ the quill. After liquids came to be the medium to record, however, the finest reeds were employed: we understand the most superior species of this article, were those which *Tournefort* saw collected in the neighbourhood of *Teflis*, the capital of *Georgia*, and who has unquestionably afforded the best description of them, of any naturalist or traveller; he thus defines them: *Arundo orientalis, tenuifolia, caule pleno, ex qua Turcæ calamos parant*. *Miller* has also, we understand, used a similar description: but, he observes, that no plants have ever been yet introduced into England. It is a kind of cane, which grows no higher than a man; the stem is only three or four lines in thickness, and solid from one knot to another, that is filled with white pith. The leaves are a foot and a half in length, eight or nine lines in breadth, enclose the knots of the stem in a sheath, but the rest is smooth, and of a bright yellow colour.

Dapper and *Hanway* confirm the above; the former says they are cultivated near the Persian gulf,

To the above description of *Tournefort*, is added the following particular. "The writing-pens are made of small reeds, or canes, of the size of the largest swan quills, which they cut and slit as we do pens, but give them a much longer

³ Vide *De la Mare* for these several regulations in the *French* police, and *Beckmann* for Germanic information.

nib. These canes are collected towards *Daurac*, along the Persian gulf, in a large fen supplied with water by the river *Hellé*, a place of Arabia, formed by an arm of the Tigris, and another of the Euphrates united; they are cut in March, when gathered, tied in bundles, and laid six months under a dunghill, where they harden and assume a beautiful colour, mixed of yellow and black. Of these the best writing-pens are made.”—*Voyages de Chardin*, vol. v.

It is remarked, that *Dioscorides*, in lib. i. cap. 114, confirms the preceding remarks of *Tournefort* and *Chardin*; *Pliny* also speaks nearly to the same purpose: adding, however, that the reed was hollow at the lower end, but, at the upper end, woolly, and destitute of pith.

A passage in *Clemens of Alexandria*, who died in the commencement of the third century, might, perhaps, with some, induce the conjecture that the Egyptians wrote with quills. This author, describing a procession of the priests, says, the *sacred writer* had in his hand a book WITH WRITING INSTRUMENTS, and on his head feathers. But to decypher which, requires a knowledge of hieroglyphical symbols, which it is not probable a man who devoted his life to Christian purposes, could acquire. But this we can venture to affirm, had no reference to writing, besides those instruments were *in the hand*: a feather in hieroglyphics denotes AIR, and probably in this signification *Juvenal* might speak figuratively, when he alludes to quills. *Horace* likewise copies *Juvenal*’s thought, and uses it, perhaps, in the same sense with that poet, when he says:

— — — — *Si celeres quatit
Pennas, resigno quæ dedit.*

HORAT. Od. iii. 29, 53.

Should credit be attached to an anonymous author of the history of Constantius, from whom *Adrian de Valois* made extracts, the use of our present quills were introduced as early as the fifth century. This author informs us, that *Theodoric*, King of the Ostrogoths, was so illiterate and stupid, that during the ten years of his reign he was not able to learn to write even four letters at the bottom of his edicts; for which reason, the four letters were cut for him in a plate of gold, which being laid upon paper, he then traced out the letters with a *quill*. History supplies various other evidences of the unfitness of men for elevated stations, where hereditary right or accident has placed them upon thrones, whose dignity they were ill able to support. The western empire, about the same period, was governed by *Justin*, whose letters were, however, cut in wood; even then

his secretary was obliged to direct his hand, whilst he traced them.

The most ancient account, which can be safely depended upon respecting quills, occurs in a passage of *Isidore*, who died in 636, who, among other instruments employed in writing, mentions both reeds and quills; which might have reference to the monastic practice of using the reed for large letters, whilst the pen was applied to the smaller. One more proof is added of quills being used in the seventh century. It occurs in a Latin poem written by *Aldhelmus*, *Adelthemus*, otherwise *Adelmus*, of a noble Saxon family, who first made the art of Latin poetry known to his countrymen. In a Latin poem, intituled *DE PENNA SCRIPTORIA*, found in *Maxima Bibliotheca patrum*, tom. xiii. p. 27. The author, however, does not speak of a goose-quill, but of a pelican's.

More instances might be added about that period, were they thought necessary.

Reeds are now used by our draughtsmen for making outlines, as are also crow and raven's quills. Likewise Turkey quills are used for strong purposes on parchment, as well as swan quills.

QUARANTINE.

Mr. Antes, a British merchant in Grand Cairo for twelve years, perfectly acquainted with Egyptian concerns, has, in his remarks on that dreadful disorder the plague, the following observations respecting quarantine. He confirms a generally received opinion, when he remarks, that "The plague is, without contradiction, the most terrible of all disorders, to which the human species is subject; at the same time, it is a disorder from which any one may be perfectly safe, who has the power to perform a strict *quarantine*, though he be in the midst of a city where it rages with the utmost fury." He adds, the general practice of Europeans in Turkey will confirm this fact; and proves, by the following observations which he made at Grand Cairo, in the years 1771 and 1781, when that calamity raged there with violence, as well as in other parts of the country, particularly in Lower Egypt.

The following appear to be among the observations essential to the performance of quarantine in a country already infected. "As soon as it is known, extreme care must be taken to avoid all association among the common people. When the contagion begins to spread, a close connexion

with every one must be avoided : to do this effectually, the houses ought to be locked, and none permitted to enter, till it has ceased.

“ The usual way among Europeans is, to make a partition of boards at the inside of their house-door ; in this partition a small door is fixed, to receive the necessary provisions ; the little door is kept constantly locked, to prevent careless servants from taking any thing in secretly ; before this door, in the inside, a tub of water is placed, into which the servant, who is kept without, puts all such victuals as will bear water, out of which they are taken with an iron hook ; but bread, rice, coffee, or any dry article, are not found to convey infection, and may, therefore, be taken in with safety, from a board upon which the servant hands them in. Such things may be also drawn up through a window, by a rope formed of the filaments of the date tree, and a basket made of its leaves ; but any thing of woollen, cotton, linen, or silk, must, on no account, be taken in during quarantine. The house-door is commonly so contrived, that the latch may be opened by a rope from above stairs, in order to let the servant bring provisions ; and there is commonly a place behind every house-door for him to sleep or sit, that he may be at hand. Letters are usually taken in by a pair of tongs, and then smoked or drawn through vinegar. Europeans commonly convey their letters, or what else they may have to send to each other, in a sealed wooden box, about which there must be no packthread, or twine : that you may be safe, you should know the persons from whom you receive them keep a strict quarantine themselves. All windows may be open, and you may take the fresh air on the tops of the houses.”

Observing the preceding regulations, no instance is yet known of its ill effects ; but many who have had the imprudence to take a single ounce of silk only, or a handkerchief from without, have lost their lives, of which he had seen instances. He states the following to be one of the ridiculous stories current in Alexandria. A man having locked himself up in his house to perform quarantine, but being unable to shave himself, sent for a barber ; and, in order not to touch him, for fear of catching the disorder, put his head out through a hole, because he would not let him touch any other part of his body. However, he paid dear for his folly, and died a few days after. There is no danger in speaking to people affected at a little distance ; such events frequently occur. The author had himself even seen people drop down dead in the streets, before he shut himself up for quarantine.

The causes of the plague, he says, are difficult to determine by physical arguments,—there is scarcely any thing in theories which practice does not contradict: indeed, that which appears true at Constantinople, or other places, often proves untrue at Grand Cairo. There is, upon the whole, so much apparent contradiction in this phænomena, that, he says, our thoughts are often at a stand, and philosophy may find much room for useful reflections.

Long experience has shown, he continues, that the infection may be readily prevented, even in the midst of surrounding danger, by such a quarantine as he has directed. The various observations he made seem to contradict many of the hitherto formed theories, which he enumerates in three heads, without, he says, being answerable for their infallibility. 1st. It has been asserted in the writings of the ancients and moderns, that Egypt was the country where the disorder originated. It has also been frequently asserted, that the yearly overflowing of the Nile, leaves such a quantity of water and mud in the ponds and lowest part of the fields, which afterwards become putrid, and consequently infects the air to such a degree, as to produce the plague. This, he says, pre-supposes the susceptibility of infection in the air. If we allow this, he continues, how could its influence be prevented by merely avoiding all communication with infected people; when, at the same time, these very same persons must breathe the air? The air is never shut out; on the contrary, it is enjoyed as much as possible, oftentimes even to sleeping in it on the tops of the houses, from the month of February till near the end of June; in which months the plague rages most, if brought thither. It may be considered if the air was infected, the many thousands who are continually sick and dying in it would not mend it, but rather increase the infection. But, he adds, the Nile has no such qualities as are imputed to it: on the contrary, he *proves*, in another place allotted to that question, that its waters *never putrefy*.

2d. It has been asserted, that it is owing to the supposed filthiness of the Turks. This, he says, must pre-suppose a corrupted air occasioned by it; which what he has advanced seems equally to contradict. Besides, he continues, it is a great injustice to the Turks to call them a filthy and dirty people. They are quite the reverse; and the better sort of them are remarkable for cleanliness; nay, this is conspicuous among all classes, because their religion enjoins frequent ablutions: and, on the whole, they are quite different to what have been supposed by Europeans. He

also adds, the streets in Grand Cairo are, on the whole, not so filthy as has been supposed, nor near so bad as many European cities, to which the peculiar local circumstances contribute not a little; fuel being so dear, that every thing which can possibly become combustible is collected and consumed by the poorer people. Dead carcasses are carried out of the city, where they, and every thing which is alimentary, are consumed by dogs which run wild about, having no masters.

3d. Several writers have supposed the plague proceeds from the canal which runs through the city; admits that the water of which is greatly corrupted by the drains, &c. which empty themselves; insomuch so, that its effects are perceived in all houses in its vicinity; by tarnishing gold and silver plate, and an intolerable stench which penetrates into the back rooms of such houses; but he, at the same moment, affirms, that the houses of most of the European merchants, resident in that city, are situated upon the immediate banks of that canal; which, he says, have been so for more than 200 years. Neither these, or other inhabitants who reside in its immediate proximity, are affected more than other people. He adds, that the truth of what he has advanced in this respect, the European physicians who have resided there can confirm. What is more material, he asserts, that those who have performed a strict quarantine have never been affected. Though this circumstance would be very pernicious to health in Europe, it is not so there.

He never could obtain sufficient ground to discover that the plague ever broke out in Egypt, without being brought thither from other countries, generally Turkey, though a traditional report prevails that it was once brought from Upper Egypt, which was the most violent; yet, whenever he pressed the question, or persisted in endeavouring to arrive at its origin, he found none who could afford satisfactory information. It has been reported, and received in Europe, he adds, as an acknowledged truth: his inquiries, however, on the spot, could never arrive at better than secondary, or *hearsay* evidence. Ingeniously adding, that though it must be allowed that traditions have frequently *some* truth in them, yet length of time has divested them of all circumstantial facts, necessary to be known, so that little dependence can now be placed in them. And he questions whether the memorable tradition of the plague of Athens, be not of an equal date.

During his twelve years residence, commencing 13th of January, 1770, to 26th same month, 1782, the plague was

three times there. On his arrival at *Alexandria* symptoms appeared,—it afterwards spread, became very violent there, as well as at *Rosetta*, and other parts of Lower Egypt; but by proper precautions it did not reach Cairo, so as to become general. However, in 1771, it was brought into that country by some Mamelukes from Constantinople; it raged with great violence, as well at Cairo as Alexandria, and other parts of Lower Egypt, and even penetrated to Upper Egypt. The Russian war then breaking out, communication between Constantinople and Smyrna ceasing in Turkish bottoms, the plague was kept from the country for that period. During the interval, there was but little of it at Constantinople, but, at the same time, the visitation was heavy at *Bagdad* and *Bassora*, where it had not been before for time immemorial. Anno 1781, it was brought first to *Alexandria*, thence to *Rosetta*, afterwards it reached Grand Cairo, by some Jews, who brought a chest of old clothes from Smyrna, where it had raged furiously, to be sold at Grand Cairo; as soon as the chest was opened, at the three different custom-houses, the infection immediately took place, and became general in a short time. Infection will remain in such articles for years together; that it will be also conveyed to any part, is an ascertained fact. In this way it remained at Cairo for a year. A Damascanee merchant had two black women slaves, who died of it; he had their clothes locked up, and twelve months afterwards took other servants, who wore the deceased's clothes, without first airing them, and who caught the infection, and communicated it to the whole country.

From what has escaped him, he thinks Egypt cannot be called the parent of the plague, and is *certain*, that by a strict quarantine in maritime towns, it might be banished that country, as well as from Europe.

He knew a person who had had it seven times and recovered, but the eighth time it was fatal. Indeed Mr. *Wortley Montague* assured him, that he had had it three times himself. The plague rages very violently in one quarter of a town, then suddenly ceases, and breaks out with violence in another. It seldom remains in Egypt after the 24th of June. He alleges, that the natural cause of the plague ceasing, at that time, is the extreme heat of the atmosphere, Fahrenheit's thermometer standing at 90° or 92°. In 1781, the plague broke out in the middle of April, and raged with such violence that it often destroyed 1000 people daily in Grand Cairo alone:—about the middle of May the wind shifted, brought on great heat,

when it immediately diminished: the weather afterwards becoming cool again, the disease returned, and did not finally leave the country till the middle of June.

From this author's observations it appears, that the heat assisting perspiration carries off the infection in Egypt. It is the same with persons who arrive from Constantinople infected with it in the hot weather, they generally recover, when neither does the infection spread in that country.

He observes, that a physician of his acquaintance, who was constantly in the habit of attending patients infected, never caught it himself, which he ascribed to his always taking copious doses of brandy, artificially promoting circulation of heat to cause a perspiration.

A reader here has made a note in my copy, without a signature, in these words: "I have read of a certain cardinal at Rome, who kept large fires during a plague, and his apartments close, and escaped the infection."

Mr. *Antes* still continues and observes, that at Constantinople extreme cold produces the same effect as in Egypt is caused by extreme heat. Also, that very old people are seldom affected by it, it chiefly operating upon the young and vigorous.

The progress of this fatal disorder in Egypt he attributes to *Coptic* superstition, they believing every man's fate to be written on his forehead.

The preceding sensible observations appear to us to furnish large materials for investigation, and they admit of ample room for reflection; also from our not having seen them given in any other publication we have read, we have thus selected the above copious extracts.

It appears that the most ancient account of the plague on record, is that above alluded unto, the *Athenian*; which is recorded by *Thucydides*, lib. ii. and expressly said to have come from Egypt. *Evagrius* also, in his *Hist. Ecclesiast.* iv. 29. *Procopius*, *de Bello Persico*, ii. 22, alleges that the dreadful plague, in the time of *Justinian*, came from that country. All the writers above quoted, say it was brought to Egypt from Ethiopia, and other countries. Those writers agree with Mr. *Antes* in not challenging Egypt as the parent of the infection. The general prevailing opinion of such ancient and modern authors whom we have consulted is, that it was brought to Europe from the East. The shores of the Levant appear, however, in latter times to have produced the infection in most parts of the world.

The celebrated Dr. Mead furnished its history up to his own time, in his *Opera Medica*. Knowing the observations

previously given, could not have been taken advantage of by his elegant and scientific pen was another reason for our being thus diffuse.

We also understand that *William Brownrigg*, published a work in 1771, intituled "*Considerations on the Means of preventing Pestilential Contagion*," in which work he is presumed to have availed himself of *Dr. Mead's* publication.

In that work, *Mr. Brownrigg* says, the *Venetians*, in the year 1484, were the first European people who established the observance of quarantine. It is noticed that this circumstance is not mentioned in *Le Bret's History of the Venetian Republic*: he only says, the grand council in 1348, chose three prudent persons, whom they ordered to investigate the best means for preserving health, and to lay the result of their inquiry before the council. The plague which afterwards broke out in 1478, rendered it expedient to establish permanent regulations; accordingly the *Sopra la Sanità* was instituted, in 1485, consisting of three noblemen. These not being able to stay the fearful contagion, they were reduced to the disagreeable necessity of imprisoning some people against whom complaints were lodged, and even of putting certain of them to death. In 1585, it was decreed that from the sentence of these judges there should be no appeal. Their principal business was to inspect the lazarettoes, erected at distant places, in which it was required that all persons and merchandize coming from suspected parts should continue a stated time, fixed by the laws. The captain of every ship was also obliged to exhibit the bill of health which he had brought with him.

Bembo likewise mentions the *Sopra la Sanità*, but does not express the year. His countryman *Lancellotti*, who must have understood him well, makes it 1491. The islands in which *pest-houses* were erected, were called *il Lazaretto vecchio*, and *il Lazaretto nuovo*. In *Thesaurus Antiquitatum Italiae*, it is stated the pest-house in the former island was built in 1423, and in the latter, in 1468.

Brownrigg says, that letters of health were first written in 1665, by the consuls of different commercial nations. Why the period of forty days quarantine was fixed upon, does not appear, from *Chenot*, to have been the result of medical observation, it not seeming that proper observations had been made to prove how long the infection would remain dormant; but such is now the usual period, and we presume that due care is directed to be taken that the contents of packages be properly fumigated, &c.

The name *quarantine*, as well as *lazaretto*, is Italian.

QUICKSILVER.

Dr. *Rees* defines it to be a ponderous heavy fluid, named by the chymists *mercury*,—he refers it to that name;—when we find that the ancients called it *hydrargyrum*, *i. e. water of silver*. The moderns call it *mercury*, from its supposed affinity to that planet. In English, *quicksilver*, a word of Dutch extraction, who called it *quack salber*, from its being used as a compound in pills for the cure of a certain disorder, and sold by ignorant pretenders to physic, whom they, by way of derision, called *quacks*, from their unmeaning jargon. From its silvery appearance, and from the variety of forms it assumes, some chymists call it *proteus*. It is thus defined by celebrated mineralogists: *native mercury*; *gedegen queck selber*, Wern.; *mercure natif*, Haüy.

It is formed in globules, in the cells of the ores of mercury, and in large masses, in drused cavities, &c. When perfectly fluid, it feels very cold, as if wet, but does not adhere to the fingers; it has neither taste or smell. In lustre, it is metallic and splendent. Spec. grav. of its component, 13.568, Cavendish; 13.581, Brisson; 13.600, Klapp.

Native mercury is occasionally pure, but sometimes is amalgamated with some silver, though not sufficiently saturated as to be referrible to the latter species in which this transition is formed.

In the following places mercury is found in abundance: Idria, the Palatinate, and Spain. It occurs almost always together with *cinnabar*, and other mercurial ores, in fletz rocks, which appear to be subordinate and to occur near some coal formation. *Native amalgam*; *natürliches amalgame*, Wern.; *mercure argental*, Haüy. Its colour varies between tin and silver.

It is seldom found massive, oftener disseminated in superficial laminae, and sometimes crystalized. The crystals hitherto discovered are the regular *octahedron* with all its edges unrevealed, mentioned by Ronne de l' Isle, *Mercure argental*, *triforme*, Haüy, pl. 65, fig. 24. The *rhomboidal*, or garnet, *dodecahedron*; *mercure argental dodécaèdre*, Haüy, ib. fig. 25; this often occurs; *Cordier* calls it primitive crystal. The preceding triunated edges, *mercure arg. triforme*, Haüy, ib. fig. 26. Also the *lencite* crystal, or double eight-sided pyramid, flatly acuminate on each extremity, by four planes set on alternate level edges, is mentioned among the modifications of its substance. The

crystals are seldom larger than small peas, generally imbedded separate, and seldom grouped together; externally shining and splendid, but less so than native mercury. Lustre, metallic; when scraped becomes dull. Fracture conchoidal, more or less soft, sometimes nearly fluid, not particularly brittle. Specific gravity 14.192, as a mean of several experiments. *Cordier*.

Besides the partly fluid amalgam, there are more solid varieties, the fracture of which is very imperfectly flat, crystalline, sometimes passing into fine grained, uneven, and which, when pressed between the fingers, or cut with a knife, in cutting it gives a more creaking sound than the other variety.

Exposed to the action of fire the mercury is calcined, and a button of silver remains. Nothing exact has transpired respecting the occurrence of this species, but probably it is confined to felsic mountains. The calx rarely resembles silver, but may be easily ascertained by its ready attraction to gold, and whitening it and copper when rubbed with it.

MERCURIAL HORN ORE. *Queck selber hornertz*, Wern.; *mercure muriate*, Haüy; usual colour, ash grey, more or less deep; often passes into yellowish grey, and greyish white; also inclines to a greenish grey. This species has many varieties; seldom found massive or disseminated, but generally in thin crusts, formed by tubicular or small globular masses, frequently crystallized; crystals minute, often gibbous, externally and internally splendid, of a complete translucent nature whenever newly concreted. It appears to be composed of fine grained and distinct concretions, generally faintly translucent, sometimes only at the edges soft, may be cut with a knife; and easily frangible.

This species is the most scarce of mercurial ores; was first discovered by Mr. Woulfe, in the quicksilver-mines of Moschellandsberg and Mörsfeld, in ferruginous clayey sandstone, accompanied with the ores of mercury, ochery stone, malachite, and blue copper ore, calcareous spar, lithomarge, &c. It has been found at Idria, generally in cavities of indurated clay, and of slate clay, accompanied with crystallized cinnabar, at Houtz, in Bohemia, with dark red cinnabar in a vein of brown iron stone; and at Horzowitz, in Bohemia, with dark red cinnabar; and at Almourin, in Spain.

MERCURIAL LIVER ORE. *Queck selber libertz*, Wern.; *liver coloured mercuria ore*, Aik.; *mercure fulure bitumifac*, Haüy. Divided by names into compact and slaty liver ore. Its colour intermediate between dark lead

gray and cochineal red. Occurs massive, and rarely disseminated; internally it is glistening, and glimmering with semi-metallic lustre; of a hue even passing sometimes into fine grained, uneven, and imperfect, large and flat conchoidal fragments intermediately angular, more or less blunt edged; it is soft, may be cut with a knife, and easily frangible. Specific gravity 7.186, 7.352, Kirwan; 7.937, Gillert.

Mr. Bradford communicated to the Society for the Encouragement of Arts, &c. that he has found quicksilver useful, in a crude state, in destroying insects on trees. On a plum-tree he made the following experiment: he took a small awl and pierced sloping through the rind and part of the wood, at the bottom of a branch covered with insects; then put in a drop or two of quicksilver, and confined it by fastening it with a plug prepared to fit the aperture. The insects fell off from that branch next day; in two more they all fell off from the tree; the tree continued in full vigour and thrived well. He next tried the same experiment on a honey-suckle, the leaves quite covered with them: here he scraped away the top of the ground with a trowel, thrust his awl in just above the root, but not to the heart; applied the mineral and secured it; this experiment was attended with like success. In both cases it was pierced only so deep as to communicate with the circulating sap or juice of the tree only, and not to affect its vitals.

It appears that the first use of quicksilver for refining of metals, which is commonly reckoned a Spanish discovery, occurred about the middle of the sixteenth century, who first employed it about that period as an amalgam for separating the more noble and precious metals from grosser and also from extraneous particles which occasionally will intrude into association with them. It also seems that Pliny and the ancients knew nothing of employing this amalgam for these purposes. The chief record we find which refers to such separation occurs in Vitruvius, who affords directions for the separation of gold and silver from cloth with which it had been interwoven: "The cloth," he says, "must be put into an earthen vessel and placed over the fire, in order that it may be burnt. The ashes are to be carefully preserved, thrown into water, and quicksilver added to them. The latter attracts the particles of gold and makes them unite with it. The water is then to be poured off, and the residue put into a piece of cloth, and squeezed with the hands; the quicksilver, on account of its fluidity, will ooze

through the pores, and the gold is left pure in a compressed mass." This direction certainly affords the earliest mention of the application of quicksilver as an amalgam.

Improved practice in the arts, and the necessity to observe economy in the use of this article, first induced the Spaniards to preserve the quicksilver thus used, collecting and separating it by fire as formerly; but instead of producing evaporation of the article, occasioning a waste of it,—it is now separated in a retort, when it is collected for further use.

Also when gold is washed from the sand found in rivers, the work is not properly finished till quicksilver has been used. But the primitive simplicity of ancient times knew of no such valuable expedient.

We have the story of the golden fleece of *Jason*. The practice then was to collect the gold in the Colchian streams, by sinking an empty sheep's fleece and dragging it along the bed of the river, when the hair or wool found and brought up numerous particles of the precious metal; these could be easily collected. Thus we see the rational explanation of many mysteries of the ancients, wrapt up, indeed, in beautiful allegory, proper to excite the wonder of their successors.

It is asserted that the previously suggested method of the Spaniards in using this amalgam, was practised previous to its discovery in Germany, by an author who is rather too jealous for the honour of his country to have *all* merit; we say *too jealous*, because he appears often to betray a want of common justice. At the time we make this confession, however, we feel inclined to allow his very ingenious countrymen every praise which is their due. They are a successfully speculative people, to whom the world is much obliged for the exercise of happy ingenuity.

Father Austin has, however, in his *Natural and Moral History of the Indies*, among a variety of valuable information, rendered an account of the quicksilver-mines of Peru, which are situated in an extensive ridge of mountains near *Guamanga*, on the south side of *Lima*; they are called the *Guancabelica*, or *Guancavilia*. Those mines were discovered about 1566, or 1567. *Henry Garcés*, a *Portuguese*, in the service of Spain, one day examining a red earth, used by the Indians for paint, on the side of a *Guamunga* mountain, at the same time remembering that in Europe quicksilver was extracted from cinnabar; with this earth he made some experiments, and fortunately discovered a source for future wealth for the Spanish people, which was one day to be

essentially beneficial to them in their search for their much adored deities, silver and gold.

It had not been thought of applying this metallic semblance to aid the operation of refining silver, until as late as anno 1571, at which period *Francis de Toledo* being the viceroy, or lieutenant, *Fernandez de Velasco* came to Peru, and proposed to refine silver by the aid of quicksilver, he having learnt the art in Mexico. His proposition was accepted; his endeavours succeeded;—when the method hitherto observed was abandoned, and the present improved one adopted. Hence, we see, that *Garces* was not the inventor, but only the means of introduction of it into Peru. As amalgamation had been long practised in Mexico, previous to its introduction to the mines in the former country, and probably originated among the uncivilized Indians, it can have no date or name affixed. *L'Abbe Raynal* observes, that quicksilver was an article of free trade till 1571, when the crown claimed it exclusively; which regulation, he says, was in consequence of its being used in refining. *Dr. Robertson*, in his *History of America*, informs us, that the mines of Guanacabelica, were discovered as we have seen.

Anderson, in the first volume of his *History of Commerce*, p. 414, quotes a passage in *Hackluyt*, where he shows that mercury had been used for this purpose as early as 1572. It was written in that year by a merchant of the name of *Hawks*, who says, “A good owner of mines must have much quicksilver; and as for this charge of quicksilver, it is a new invention, which they will find more profitable than to fine their ore with lead.”

Gobet, in his work, “The ancient Mineralogists of France,” alleges that *Alphonso Barba* had claimed the discovery of amalgamation as early as the year 1609. *Alphonso Barba* had assuredly written his work upon Spanish metallurgy, which was published at Madrid, in 1640, in his native tongue. This book, Spain, through jealousy, concealed; but Lord Sandwich, being ambassador at the court of Madrid, found opportunity to procure a copy, which he translated into English, whence translations into several European languages have been made. Earl Sandwich's translation was published in London, in 1674, subsequent to his lordship's death: it is intitled “*The First Book of the Art of Metals, in which is declared the Manner of their Generation, and the Concomitants of them; written in Spanish, by Albaro Alfonso Barba, translated by the Earl of Sandwich.*” Many editions were collated and transcribed by the directions of the eminent *Leibnitz*. Anno 1751, a new

translation was published at Paris, intituled "*Metallurgy, or the Art of extracting and purifying Metals*," translated from the Spanish of Alphonso Barba, by M. Gosfort, to which is added a dissertation on mines and metallic operations; of which translation the very eminent Abbé Lenglet du Fresnoy is said to have been the editor.

It should appear that Gobet has been doing an injustice to Barba, as Barba expressly says, he does not believe the ancients were acquainted with the art of extracting silver from pounded ore, by the means of quicksilver. Hence it certainly does not appear that he claimed the invention; besides, he always speaks of amalgamation as being an art long practised in America. Barba only complains of the negligence with which the American miners had hitherto practised it. A passage appears in the Vienna edition of 1609, which recites the mode by which Barba had attempted to fix the quicksilver; with that idea he thought of mixing it with the silver ore, and at first really believed he had obtained a mass of silver; but he soon perceived the mercury was not transmuted, but that attraction only had taken place. "I was," says Barba, "highly pleased with my new discovery of managing ore, of extracting its contents, and of refining it: this method I continued to practise." Hence it is submitted Barba did not wish to claim the invention himself; he speaks in consistent language when he says, he was pleased with the *discovery*; yet we certainly may inquire, what induces him to speak of it as his discovery, and calling it a new one, if the facts were not strictly applicable? Differing from the opinion just given, we conceive if the discovery was not his own, he learnt it in America, and first introduced its use into Europe.

SADDLES, BRIDLES, AND STIRRUPS.

In the earliest ages it was customary to ride without either bridles or saddles, if the poet be worthy of credit; for we observe *Lucan*, speaking of the Massillians, says:

*Et gens quæ residens Massylia dorso
Ora levi flectit pænorum nescia virgá.*

"Without a saddle the Massillians ride,
"And with a bending switch their horses guide."

They regulated the motion of the horses by this switch and their voice. It has been observed, that the case was the same with the Numidians, Getulians, Libyans, as well as most of the Grecian people. As the reason of the thing

appears to point out the superior expediency of a bridle, they afterwards came into fashion, as we are informed the Greek name for a bridle was *Αῦλοι*, which the Latins called *lupi*; because, it is said, the bit of the bridle bore a resemblance to the teeth of the wolf, whence Lucan says of it:

———— Gallica nec lupatis
Temperet era pænis.

“ Nor with the sharper bits
 “ Manage th’ unruly horse.”

In the east, it should appear, that *bridles*, at least, were introduced at an early period. For we have a great number of texts in the scripture, which definitely express as much: in the *Psalms*, and likewise in *Proverbs*, the name and application of the bridle is often definitely mentioned, and more frequently alluded unto. Virgil, indeed, says, referring to very early times:

Frena Pelethronii Lapithæ gyrosque dedere
Impositi dorso.

Georg. iii. 115.

“ The Lapithæ of Pelèthronium rode -
 “ With bridles first,—and what their use was show’d.”

POTTER.

As does also the name *saddle* literally occur in the 1 Kings, chap. xiii. ver. 13. “ And he said unto his sons, *saddle* me the ass. So they saddled him the ass: and he rode thereon.” And before that period, in the second generation after Noah, the Assyrian empire was established. In its commencement, even as early as the days of *Semiramis*, the famous wife of *Ninus*, the first Assyrian king, who built *Nineveh*, there were those articles of horse furniture, called *packs* and *fardels*; for in Diodorus Siculus the following passage occurs in this respect. “ Semiramis ascended from the plain to the top of the mountain, by laying the *packs* and *fardels* of the beasts that followed her, one upon another.” Diod. Sic. lib. ii. cap. 1. The author informs us this mountain was in *Medea*, its name was Mount *Bagistan*, and that it was seventeen furlongs from the top to the bottom.

Pliny likewise says, that one *Pelethronius* first introduced this practice; however, who *Pelethronius* was, has not, we believe, been discovered. In the first ages, among the Greeks and Romans, a cloth or mattress, a piece of leather or raw hide, was all they used for a saddle. Such coverings afterwards became more costly; *Silius Italicus* says, they were made of costly skins. In lib. v. ver. 148, he says:

Stat sonipes, vexatque ferox humentia frena,
Caucasium instratus virgato corpore tigrim.

Suetonius likewise mentions in the *Thebiad*, lib. iv. v. 272, splendid coverings. Virgil also mentions in the 7th *Æneid*, v. 276, and again in the 8th, v. 552: as does Ovid, in the *Metamorph.* lib. vii. v. 33: and moreover Livy, in lib. xxxi. cap. 7, with numerous other instances might be cited, were not many of those already adduced thought to be superfluous.

Moreover, also, *Montfaucon* hath supplied us with some beautiful graphic delineations in tom. ii. of his *Antiquité Expliquée*, plates 27, 28, 29, and 30, of those articles which were used by the Greeks and Romans, taken from antique monuments. It, however, appears that after they were even become common, it was considered as effeminate to use them; hence the Romans despised them: and, in his old age, *Varro* boasts of having, when young, rode without a covering to his horse. *Xenophon* reproaches the Persians, because they put more clothes upon the backs of their horses than upon their beds. From the aspect in which hardy people viewed this practice, the warlike *Teutones* considered it most disgraceful, and despised the Roman cavalry.

Dion Cassius relates, that coverings were first directed for the Roman horse by Nero: the authenticity of his relation is however questioned; it has been suspected he alludes only to reviews: before this period they did without them. In the time of *Alexander Severus*, the Roman horse had beautiful coverings. However, at that period, it seems saddles, like those we now use, were unknown. The invention of saddles, on a principle similar to those now in use, is conceived to have occurred anterior to the reign of *Theodosius*,¹ anno 385; for it appears, that at that period, he made an order that those who wished to ride post-horses, should use saddles of a less weight than sixty pounds. Should the saddle be heavier, it was to be cut to pieces.

That saddles were used in war, in the time of *Constantine*, may, we conceive, be inferred from a passage in *Nazarius's* panegyric, who, in describing the destruction of the enemy's cavalry, says they hung *sedilibus*.²

In the fifth century, saddles were so very magnificent, that a sumptuary prohibition was issued by *Leo I.* which directed that they should not be ornamented with pearls or precious stones. In the sixth century, the Emperor *Mauritius* directed they should have coverings of fur, of large dimensions.

¹ Codex Theodos. lib. viii. tit. 5. leg. 47. See likewise the Justinian Code, lib. xii. tit. 51, &c.

² Cap. 24.

*Du Cange*³ has collected all the terms of art relative to this portion of equestrian furniture, and much information on the subject, to whom the reader is referred for further information.

From every information we have been able to collect, we believe that the appendage of stirrups were not added to saddles before the sixth century. It is said, that previous to the introduction of stirrups, the young and agile used to mount their horses by vaulting upon them, which many did in an expert and graceful manner; of course practice was essential to this perfection; consequently, that this should be afforded, there were placed, in the Campus Martius in Rome, wooden horses, where this exercise was performed of mounting or dismounting on either side; first without, and next with arms. Cavalry had also occasionally a strap of leather, or a metallic projection affixed to their spears, in or upon which the foot being placed, the ascent became more practicable. The invention and name of stirrup is said to have been borrowed from the anatomy of the ear, where a band is found resembling it in form. Respecting the era of this invention, *Montfaucon* has presumed that the invention must have been subsequent to the use of saddles; however, opposed to this opinion, an ingenious argument has been offered, that it is possible they might have been anterior to that invention; because, it is said, they might have been appended to a girth round the body of the horse. Both *Hippocrates* and *Galen* speak of a disease to which the feet and ancles were subject, from long and frequent riding, occasioned by suspension of the feet without a resting place. The Roman, *Suetonius*, informs us, that Germanicus, the father of Caligula, was wont to ride after dinner to strengthen his ancles, by the action of riding affording the blood freer circulation in the part. At the periods previously mentioned, it appears to be evident they had not been introduced.

The Latin names assigned them have been various, being called *staffa*, *stapia*, *staphium*, *stapha*, *stapedium*, *stapeda*, *stapes*, and lastly *scalæ*; in which last sense *Mauritius*, in his treatise on the art of war, is said to have named them.⁴ Now, this last writer is supposed to have lived in the sixth century; but we conceive it is pretty evident they had an earlier existence in Arabia, Turkey, and Persia, having seen an alto, as well as bas-relief of this last country, which is

³ Vide under the article *Sellam Gestare*.

⁴ *Mauricii Ars Militaris*, edita a Joh. Scheffero. Upsaliæ, 1664, 8vo, p. 22.

believed to have been as ancient as the days of *Darius*, the son of *Hystaspes*, because it was brought from the city he built, *Persepolis*, having this representation.

SAFFRON.

The plant we know by that name, still in botany retains its ancient appellation; it is called *crocus*: of which there are two species, one of them blossoms in spring, and the other is in flower in autumn. The flowers of the latter species, which appears in germ before the *green* leaves, (retaining its leaves through the winter,) contains those small threads, or filaments, which were used in medicine, food, and for the purposes of painting and dyeing, among the ancients.

This little valuable plant has virtues in medicine which were soon discovered by ancient botanists, and which the modern practisers in the healing art still appreciate. For as the rudiments of medical knowledge were derived by Europe from Greece, previous to the mode of its culture being known in Europe, it formed a portion of their *materia medica* and of the trade of the Levant. The ancients describe it as a bulbous plant, growing wild in the mountains, as appears from the writings of *Theophrastus*, *Histor. Plant.* lib. vi. cap. 6. *Geopon.* lib. xi. cap. 26, and *Pliny*, lib. xxi. cap. 6.

The taste of the ancients appears to have differed from the *gout* of the moderns; for the most luxurious of the former employed it in numerous of their made dishes, in sauces, &c. and, what is more strange, they universally employed it as an agreeable perfume! as innumerable passages in their dramatists and poets inform us. As the public are agreeably apprised of their taste in dishes, in one of Smollet's inimitable novels, we shall not attempt to debase his description by any feeble efforts of our own pen. But really the relish of Apicius for fricasees of sucking puppeys, sausages, with singular mixtures of ingredients, and other eccentricities of his flavour, could not be mentioned with a certainty of safety in the presence of a modern table, without incurring the risk to make the stomach render its contents by the same *way* it was filled.

We read of their fumigating their baths, theatres, halls, and all places of public fashionable assemblage, with the odour of this plant. Of the ancient opinion respecting the agreeable flavour of its scent, we can collect an idea from the 809th verse of Lucan's *Pharsalia*, where he says, de-

scribing the fluxion of the blood from a sufferer who had been bitten by a certain kind of African serpent, that it spouted out in a similar manner to the “*sweet smelling essence of SAFFRON issuing from the limbs of a statue.*”

From saffron, also, the ancients made themselves a kind of perfumed salve, which they used in the middle ages, as the most remote in antiquity did their balsams, and as we now apply pomatum.

That our organic formation is the same as was that of the ancients, we conceive cannot be questioned: that being admitted, the difference of our affections and theirs may be thus reconciled; considering that moderns have now so far improved the horticultural art, as to produce flowers of such exquisite flavour, that no comparison can exist between us; and also superior chymical science has discovered the means to extract and fix perfumes from them in various salts, so as to render them stronger, more volatile, as well as agreeable, of which, it is presumed, they never had a conception.

The present smelling-bottles used by our belles far surpass those which *Catullus* promises his friend, with the assurance that it is the same his mistress had received from Venus and her Cupids, so that when he smelt he would wish to become all nose.

*Nam unguentum dabo quod meæ puellæ
Donarunt Veneres Cupidinesque,
Quod tu quom olfacies, deos rogabis,
Totum ut te faciant, Fabulle, nasum.*

Leaving the *hypochondrical* patient out of the question, who has imagined his head to be made of glass, with numberless other extravagances; a state of mental infirmity which cannot be even thought of too delicately, or can the sufferer be enough commiserated; but even persons enjoying all the healthy energies of body and mind, from habitual indulgence in any particular mode, passion, or feeling, are apt to *imagine* that what *appears* a gratification to others, would be intolerable to themselves; therefore, we think we may conclude, from this observation, that our imaginations generally assist in forming, and also that habitual indulgence confirms peculiar tastes. The use of brandy and tobacco were first recommended medicinally; however, they were found so agreeable to some flavours, that their constant use was adopted, and has been ever since persisted in. The same observation also nearly applies to snuff; with its deleterious qualities a young snuff-taker is conscious, but he, perhaps, feels at first a pleasure in the practice from that cause; however, its effects are soon so familiar, as the organs

from use of this drug, become so callous to feeling, that a moderate quantity, which at first served to communicate a species of pleasure from its novelty, will not any longer suffice, till proceeding progressively, he may be induced to mix pernicious drugs with the article, which destroy in time the sensibility of the olfactory organs, and renders them insensible to pleasure or pain.

From what we have seen, it is not to be questioned but that the use of saffron was employed, as we have mentioned, by the ancients. Should a doubt yet remain, we quote the oldest book on cookery extant, ascribed to *Apicius*, which, according to *H. Stephen's* translation, runs thus: "Saffron must be put into all Lent soups, sauces, and dishes; without saffron we cannot have well-cooked peas."¹

A story is related in *Hackluyt's* voyages, vol. ii. p. 164, and *Campbell's* Political Survey, vol. ii. p. 101, and other authors, of a hermit, who, proposing to do good to his country, enclosed in his staff a bulb of saffron, which, it is said, he did at the hazard of his life, and first brought it to England; which circumstance, it is added, first gave the name to *Saffron-Walden*, in Essex.²

It was originally imported into most European nations from the Levant, as we have seen, concerning which laws have been made in various countries respecting it; of which we have one cited by *De la Mare*, in his *Traité de la Police*, iii. p. 423: when the French legislature interfered, to prevent improper adulteration of the article, alleging, that besides its injury to health, it spoilt the saffron trade, and thereby deteriorated the revenues of the kingdom.

The name has been said to be derived from the Turkish language, by some *zæ'feran*, which *Meninski* renders *crocus*. Others say it came from the Persian, see *Chardin's* travels. Whilst the Spaniards say they had *safran* from the Vandals.

SOWING MACHINE.

The present instrument, found so useful for agricultural purposes, was invented by an Italian, of the name of *Joseph Locatelli*, a nobleman of *Carinthia*, in the year 1663; although it has been alleged, that the mention of such an

¹ Le saffran doit être mis en tous les potages, sauces et viandes quadragésimales. Sans le saffran, nous n'aurions jamais bonne purée, bon pois passés, ni bonne sauce. *Apologie pour Herodote*, par *H. Estiene*. A la Haye, 1735, 2 vol. 8vo.

² See also *Harrison's* Political History of Britain, by *J. Campbell*. London, 1774, 4to. ii. p. 101.

instrument occurs in *Theophrastus*; but not sufficiently definite to ascertain if it be applicable to those purposes for which the present sowing-machine is used. The first experiment was made with *Locatelli's* machine, in the presence of a commissioner, named *Pietro Bonaventura von Crollolanza*, appointed for that purpose. Those experiments succeeded so well, that a crop of sixty for one was obtained from land unmanured, and subject to frequent inundation. On this account, the Emperor (Rudolphus II.) rewarded the inventor, and sent him with letters of recommendation to the King of Spain.

Locatelli's machine was exceedingly simple, consisting of a seed-box, the cylinder of which was furnished with two small wheels, which required to be only hooked or fastened, by means of ropes, to the stilt of the plough.

We learn from Evelyn, who, in 1669, gave to the Royal Society of London a complete description of Locatelli's invention, that the inventor went to Spain with his machine, where he proved the advantage of it by public experiments, and described them in a publication in the Spanish language, dedicated to *Geronimo de Camargo*, member of the *Consejo real de Castilla*, who was commissioned by the King to make known and promote the use of this machine, the sale of which was secured to the inventor, at a price fixed in his patent. This Spanish work, from whence Evelyn made his extract, was printed with the approbation of the Austrian Crollolanza, 1st August, 1663.

Various have been the projected and practical improvements in this machine, since the period of its original introduction; many of those, however, from the too frequent fate attending on such designs, proved so complex, soon got out of repair, and the reinstatement of which became too expensive for general purposes. Simplicity is a requisite very essential to every species of machinery, but is particularly so in all cases where it is probable the direction of its operations are to be left to rude and vulgar hands. The advantages resulting from this mode of agricultural improvement, are too well known to be here insisted upon.

STAMPING-WORKS.

The term which designates those machinery where ores are prepared for the smelting-furnace, is, we believe, a comparatively modern term; but the application of means to obtain a similar effect is of great antiquity. We have

numerous ancient authorities who describe the process with admirable precision; particularly Agatharcides, Hippocrates, Diodorus, the Sicilian, and Pliny: the first and third relate to the metallurgy of Egypt; the second to that of Greece; and the last to the metallurgy of the Romans. However, since Diodorus Siculus is minutely circumstantial in his description of the Egyptian practice, and as the others differ from him but very little, or scarcely any thing in effect,—we subjoin from that author an extract, taken from the first chapter of his third book; observing, that the chief sentiment which appears to pervade the mind of the author, is a praiseworthy compassion for the poor creatures employed. Their distress appears to be painted with a feeling pencil, in a manner which does his heart great honour, at the time an honest indignation is raised against the tyrannical and cruel oppression of the innocent. But with this mixed sentiment, we cannot help admiring the wisdom of those laws which, at the time legislative prudence found a mode proper for the punishment of guilt, rendered the future existence of the criminal serviceable to his country, whose institutions he had disregarded. Contending that the certainty of corporeal punishment, for an unknown period of time, will be found to be more operative upon the common mind of humanity; and, we submit, would tend to *prevent* the commission of crime infinitely more than would the certain prospect of a termination of life, at a certain period, which they know, from what they see in others, must happen to themselves sooner or later. We, therefore, with becoming reverence for superior information, submit, that were the criminal code of a certain country, eminent for its sanguinary complexion, to be modelled upon the design of ancient Egyptian legislation, allowing no possibility of escape from punishment by verbal inadvertency or mistake in legal proceedings, if guilt be proved; nor scarcely admitting the hope of pardon in supreme authority; that it would be a much more efficacious mode to prevent offences than sanguinary laws, where so many loop-holes are offered to permit offenders, whose previous characters are not proved to be, at least, comparatively innocent, to escape a certain and transitory suffering. For the mode in which offenders reason, is supposed to be the following: “If I steal such a thing, there are, at least, numerous chances, but I shall escape punishment; first, I must be dextrous, nor suffer any to see the offence committed. Next, suppose I should be taken, I may prove an *alibi*; or should it be found upon me, I have the benefit of some cunning lawyer to help me out of it, by depreciating the value,

finding a flaw in the indictment, &c. &c.; and even then, I may stand the chance to be imprisoned for a certain period, where I shall meet many of my old friends, and live better *in* prison than I should *out* of it: therefore there are many chances in my favour in that respect. Or even admitting I should be sentenced to transportation, I shall see other countries, and even, perhaps, there make my fortune. Should I be hanged, it is better to have a short life and a merry one, than to put up with all the horrors of famine and the misery I now endure." Such, we will suppose, is the species of reasoning employed by the unprincipled, who have no sense of the indecency of trampling upon those laws which protect society, nor any sense of preserving a spotless and unsullied character, and leaving an honest reputation behind them. Nevertheless, at the time we render our unqualified sense of approbation, as it respects the wisdom of Egyptian legislation, for the reasons previously given, we cannot, without violating the principles given us by nature, refrain from just reprehension for the cruelty of that indiscriminating course, which Egypt, with most oriental countries has pursued, of including in the gross of punishment, the unfortunate captives taken in war, and the innocent relatives of offending culprits convicted of any crime against the state or king. This is so sanguinary a feature, that we mistrust their former approved wisdom.

But not to indulge our own loquacity further, we proceed to give the extracts which produced these reflections, upon which we leave our readers to form their own conclusions, at the time we apologize for this our intrusion. First observing, that it was, and is even now, in some eastern countries, the practice to kill the unoffending relatives of offenders against the state or religion, and even to burn and raze the very houses in which they lived. Such is, we have understood, a general practice in Bagdad, and other eastern despotic countries.

"The miners were strictly guarded by military, so that," the historian says, "it was impossible for any to escape. The earth which is hardest and full of gold, they soften by putting fire under it, and then work it out with their hands: the rocks thus softened, and made more pliant and yielding, several thousands of profligate wretches break in pieces, with hammers and pick-axes. There is one artist, who is overseer of the work, who marks out the stone, and shows the labourers the way and manner how he would have it done. Those, the strongest among them, are appointed to this slavery, are provided with sharp iron pick-axes; they

cleave the marble-shining rock by mere force, and not by slight of hand; they undermine not the rock in a direct line, but follow the bright shining vein of the mine.

“ They carry lamps, fastened to their foreheads, to give them light; otherwise, they could not find their way in the various windings and turnings wrought in the mine, and having their bodies sometimes appearing of one colour, and sometimes of another, (according to the nature of the mine where they work.) They throw the lumps and pieces of the stone, cut out of the rock, upon the floor. And thus they are employed continually, without intermission, at the very nod of the overseer, or task-master, who lashes them besides. And there are little boys who attend upon the labourers in the mine, and with great labour and toil, gather up the lumps and pieces hewed out of the rock, and carry them forth and lay them upon the heap. Those who are about thirty years of age, take a piece of the rock of such a certain quantity, and pound it in a stone mortar, with iron pestles, till it be as small as a vetch; then those little stones so pounded, are taken from them by women and older men, who cast them into mills, which stand together there near at hand in a long row, and two or three of them being employed at one mill, they grind it so long till it be as small as meal, according to the pattern given them. No care at all is taken of the bodies of these poor creatures, so they have not so much as a rag to cover their nakedness; no man who sees them can choose but must commiserate their sad and deplorable condition. For though they are sick, maimed, or lame, no rest,—no intermission in the least is allowed them; neither the weakness of age, nor women’s infirmities, are any plea to excuse them; but all are driven to their work with blows and cudgelling, till, at length, overborne with the intolerable weight of their misery, they drop down dead in the midst of their insufferable labours; so that these poor creatures always expect worse to come, than that which they at present endure; and, therefore, death is far more desirable than life.

“ At length, the masters of the work take the stone thus ground to powder, and carry it away, in order to the perfecting of it. They spread the mineral so ground upon a broad board, somewhat hollow, and lying shelving, and pour water upon it, rub and cleanse it; and all the earthy and drossy part being separated from the rest by the water, it runs off the board, and the gold, by reason of its weight, remains behind. Then washing it several times again, they first rub it slightly with their hands; afterwards they draw

up the earthy and drossy matter with slender sponges, gently applied to the powdered dust, till it be pure clean gold. At last, the workmen take it away by weight and measure; and put it into earthen urns; according to the quantity of gold in every urn, they mix with it some lead and grains of salt, a little tin, and barley bran. Then covering every pot close, and carefully daubing them over with clay, they put them in a furnace, where they abide five days and nights together: then after they have stood a convenient time, nothing of the other matter is to be found in the pots, but only pure refined gold, some little thing diminished in its weight."

Here the ancient practice of pulverizing ores and washing, in Egypt and Ethiopia, is very circumstantially given; we gave the complete extract, 1st, because it should appear in the collective sense of the author, and to show that this is no *modern* invention: and 2d, because it agrees with the simplicity of ancient times, and also shows with how much misery that precious metal was procured. How much calamity it afterwards occasioned, being employed as a sinew of war, is not our province to inquire; that we leave to the experience and judgment of our readers.

The modes now practised, are the *dry*, for less costly minerals; and the *wet* for such as are more valuable: the latter method was also invented for the ease and benefit of the workmen, as well as to preserve their health. There appear two claimants for the introduction of machinery. The first, in point of time, *i. e.* as early as 1505, was a Saxon nobleman, of the name of Von Maltitz, and who, as it appears from the authority of *Gauhen's Dictionary*, was surveyor of mines and forests, at Erzgebürge, to the Elector of Saxony. Others have asserted, that machinery for pulverizing ores, was invented by Paul Grommestetter, in Joachimsthal, a native of Swarz, in 1519; first practised in 1521: who is eulogized by Melzer as an ingenious *washer*. And it is said his machinery was established at Schneeberg, a little before 1521, according to *Meisnischer, Bergk-Chronica*, Dresden, 1590, p. 75 and 76.

The species of machinery, by which the operation is performed, as near as we can collect, is as follows:

"A large beam, shod with iron, is raised by a cylinder, furnished with cogs, somewhat similar to that used by workmen to drive piles in the construction of bridges; the difference, however, in the two species of machinery consists in this: the latter is raised by a windlass; whereas, the former are elevated by a water-wheel. A strong trough is pre-

pared, cased with iron, into which the ore is put; the beam being let down from a proper height, the iron shoeing of the hammer, which falls with its head still suspended to its beam, bruises the ore into a state proper for the furnace; whilst, in the former case for driving piles, the weight is disengaged from the rope, and suffered to fall upon the head of the pile, when it has risen to a given height."

Two persons, of the names of Krug and Klerer, are reported to have introduced the wet method in 1572.

STEAM-ENGINES.

The STEAM-ENGINE is one of the most important of human discoveries, and is certainly one of those which afford the greatest portion of ease and advantage to the human species, as well in the operation of its cause, as in its ultimate effects. This most powerful of machines, had its origin from the single idea of one individual, of our own nation. It has been, from time to time, improved by different individuals, also Englishmen, the precise periods of which improvements can be traced, and their effects fortunately ascertained.

Although, we should observe, that the first principle of this mechanical power was discovered by some of the ancient nations, many ages before that which gave the origin to the present practised invention, but from the state of information, it is conceived, to answer no purpose of utility. It may be said to have occurred in a small machine, which the ancients called an *Æolipila*, or *Æolipile*, (*i. e.* the ball of *Æolus*,) consisting of a hollow ball of metal, with a slender neck, or pipe, also of metal, having a small orifice opening into the ball, by means of a screw; this pipe being taken out, the ball being filled with water, and the pipe again screwed in, the ball is heated, there issues from the orifice, when sufficiently hot, a vapour with great violence and noise; care was required that this orifice should not be by accident stopped, if it were, the machine would infallibly burst, and, perhaps, to the danger of the lives of all in its vicinity, so immense is its power.

Another way of introducing the water was, first to heat the ball when empty, and then suddenly to immerse it in water. *Descartes*, in particular, has used this instrument to account for the natural generation of winds. *Chauvin* thinks it might be applied, instead of bellows, to blow a fire. It would admirably serve to fumigate a room, being filled with perfumed, instead of common water. It has been said to

have been applied to clear chimneys of their soot, a practice still alleged to be common in Italy. Dr. *Plott*, in his *History of Staffordshire*, records this singular custom, where the *Æolipile* is used to blow the fire. “The lord of the manor of *Essington*, is bound by his tenure to drive a goose, every new year’s day, three times round the hall of the Lord of *Hilton*, while *Jack of Hilton*, a brazen *Æolipile*, blows the fire.” The last circumstance we shall mention of this instrument, has relation to an antique one, discovered whilst digging the *Basingstoke Canal*, representing a grotesque metallic figure, in which the blast proceeded from the mouth. This figure is now possessed by the Society of Antiquaries of London.¹ In this instrument the uncommon elastic force of steam was recognised before the suggestion of the Marquis of Worcester, which follows. “In 1655, or subsequent thereto, the Marquis of Worcester published the earliest account of the application of this power for purposes of utility, and suggested it as applicable to raising water. It was the sixty-eighth of his *Century of the names and scantlings of inventions*, which his Lordship submitted to the King and parliament, anno 1663, for their encouragement, to enable him to perfect those 100 inventions. In which proposition it is thus described. “Sixty-eight. An admirable and most forcible way to drive up water by fire; not by drawing or sucking it upwards, for that would be what the philosopher calleth it, *intra spherum actroctatis*, which is, but at such a distance. But this way hath no bounder, if the vessel be strong enough; for I have taken a whole piece of cannon, whereof the end was burst, stopping and screwing up the broken end, as also the touch-hole; and making a constant fire under it, within twenty-four hours it burst and made a great crack; so that having a way to make my vessels, so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water run like a constant fountain stream forty feet high: one vessel of cold water being consumed, another begins to force and refill with cold water; and so successively; the fire being tended and kept constant, which the selfsame person may likewise abundantly perform, in the interim between the necessity of turning the cocks.”

The Marquis’s ingenuity did not, it appears, meet with that attention which it ought, from those to whom his communication was addressed. In the article of steam, it has been since very much improved, and is acted upon for the

¹ See Johnson and Flexney’s *Encyclopædia*, vol. i.

most useful of purposes, also his ideas for *short-hand telegraphs, floating-baths, escutcheons for locks, moulds for candles, and a mode to disengage horses from a carriage, after they have taken fright*; which, with several others, proclaim the originality and ingenuity of his mind.

Since his time, another design upon the same principle, has been projected by Captain Thomas Savery, a commissioner of sick and wounded, who, in the year 1698, obtained a patent for “a new invention for raising water, and occasioning motion to all sorts of mill-work, by the impellent force of fire.” This patent bears date the 25th July, 16 of William III. anno 1698. The patent states, that the invention will be of great use for drawing of mines, serving towns with water, and working all sorts of mills. “Mr. Savery, June 14th, 1699, entertained the Royal Society with showing a model of his engine for raising water by help of fire, which he set to work before them; the experiment succeeded according to expectation.”²

The above memoir is accompanied with a copper-plate figure, with references by way of description; from whence, it appears, that the engine then shown by Captain Savery, was for raising water, not only by the expansive force of steam, like the Marquis of Worcester's, but also by the condensation of steam, the water being first raised by the pressure of a rarefied atmosphere to a given height, by the expansive force of steam, in the same manner as the Marquis proposed. This action was performed alternately in two receivers, so that while the vacuum formed in one was drawing up water from the well, the pressure of steam in the other was forcing up water into the reservoir; but both receivers being supplied by one suction-pipe and one forcing-pipe, the engine could be made to keep a continual stream, so as to suffer very little interruption. This engine of Captain Savery's displays much ingenuity, and is almost as perfect in its contrivance as the same engine hath been made since his time. We regret, that without a figure we cannot supply a perfect description of it.

However, it appears, that it was necessary to have two boilers, or vessels of copper, one large and the other smaller; those boilers have a gauge-pipe inserted into the smaller boiler, within eight inches of its bottom, and about the centre of the side of the larger boiler; the small boiler must be filled quite full of water, and the larger one only about two-thirds full. The fire is then to be lighted beneath the

² Transactions of the Royal Society in that year.

large boiler to make the water boil, by which means the steam being confined will be greatly compressed, and will, therefore, on opening a way for it to issue out, (which is done by pushing the handle of a regulator from the operator,) rush with great vehemence through a steam-pipe into a receiver, driving out all the air before it, forcing it up into a force-pipe through a clack, as may be perceived from its noise; when the air is all expelled, the receiver will be very much heated by the steam. When it is thoroughly emptied of atmospheric air, and grown very hot, which may be both seen and felt, then the handle of the regulator is to be drawn towards the operator, by which means the first steam-pipe will be stopped; so that no more steam can arise into the first receiver, by which means a second receiver will be filled in a like manner. Whilst this is doing, some cold water must be poured on the first receiver, by which means the steam in it will be cooled, and thereby condensed into smaller room: consequently, the pressure in the valve, or cock, at the bottom of the receiver; there being nothing to counterbalance the atmospheric pressure at the surface of the receiver in the inner part of the sucking-pipe, therefore it will be pressed up into the receiver, driving up before it the valve at the bottom, which afterwards falling again, prevents the descent of the water that way. Then the first receiver being, in the mean time, emptied of its air, push the handle of the regulator, and the steam which rises from the boiler will act upon the surface of the water contained in the first receiver, where the force or pressure upon it still increasing its elasticity, till it exceeds the weight of a column of water in another receiving pipe, then it will necessarily drive up through the passage into the force-pipe, and eventually discharge itself at the top of the machinery.

After the same manner, though alternately, is the first receiver filled and emptied of water, and by this means a regular stream kept continually running out of the top of a force-pipe, and so the water is raised very often from the bottom of a mine, to the place where it is meant to be discharged.

It should be added, that after the machine begins to work, and the water has risen into and filled the force-pipe, it fills also a little cistern, and by that means fills another pipe, called the condensing-pipe, which may be turned either way over any of the receivers, when either is thoroughly heated by the steam, to condense the steam within, thereby producing a *vacuum* which absorbs the water out of the well into the receiver, on the principle of a syphon. Also a little above the cistern, goes

another pipe to convey the water from the force-pipe into the lesser boiler, for the purpose of replenishing the great boiler, when the water in it begins to be almost consumed. Whenever there is occasion for this, the cock is to be turned which communicates between the force-pipe and the lesser boiler, to close it effectually; at the same time, having put a little fire beneath the small boiler, which will grow hot, its own steam, which has no vent to escape, pressing on its surface, will force the water up another pipe, through an aperture, into the great boiler, and so long will it run till the surface of the water gets so low as to be below the bottom of the pipe of communication, then the steam and water running together, will cause the valve (called a clack) to strike, which will intimate to the operator that it hath discharged itself into the greater boiler, and carried in as much water as is then necessary; after which, by turning a cock, as much fresh water is let in as may be necessary; and then, by turning another cock, new fresh water is let out of a recipient into the less boiler, as before; and thus the engine is supplied, without fear of decay, or any delay in the operations; and proper attention in the workmen is only necessary to prevent disorder in a machine so expensive and complicated.

Also, to know when the great boiler wants replenishing, turn the gauge cock, if water come out, it does not need a supply; but if steam alone, then the want of supply is certain. The like with the cock with which the lesser boiler is prepared for the same purpose, when the same state will be marked by like results. In working this engine, very little skill and less labour is required: *ATTENTION is the chief requisite*; it is only to be injured by want of due care, extreme stupidity, or wilful neglect.

The engine above described, does not differ essentially from that first designed by the inventor, Captain Savery; the chief alteration which now occurs, is only in some few slight particulars. For instance, the original engine had only one boiler, and there was no ready means for supplying it with water, to remedy the waste occasioned by evaporation of steam, without stopping the action of the engine, whenever the boiler was emptied, to such a degree as to risk burning the vessel. After it was replenished, the machine was of no effect till it boiled again.

The description of the engine formerly mentioned, is transcribed from Mr. Savery's publication, "*The Miner's Friend*," and which had a subsidiary boiler, with water of a boiling heat, always ready to supply the larger boiler; and the power

of steam raised in it is employed to force the water into the larger boiler, to replace the waste occasioned by evaporation from that boiler; by this means the transposition of the feeding water is not only speedily performed, but being itself of a boiling heat, it is instantly ready to produce steam for carrying on the work. There is also one more grand improvement in the modern machine: the first engine was worked by four separate cocks, which the operator was obliged to turn separately at every change of stroke; if he turned them wrong, he was not only liable to damage the engine, but he prevented its effect, and, at the same time, lost a part of the operation: whereas, in the improved engine, the communications are made by a double sliding valve, or, as it has since been termed, regulator; that is, a brass plate, shaped like a fan, and moving on a centre within the boiler, so as to slide horizontally in contact with the under surface of the cover of the boiler, to which it is accurately fitted by grinding, and thus, at pleasure, opens or shuts the orifices, or entries, to the steam-pipes of the two receivers alternately. This regulator acts with less friction than a cock of equal bore, and by the motion of a single handle backwards, at once opens the proper steam-pipe from one receiver, and closes that which belongs to the other receiver. Captain Savery, in his publication before noticed, describes the uses to which this engine may be applied, besides those before described, *i. e.* 1st, to serve water for turning all sorts of mills; 2d, for supplying palaces, noblemen and gentlemen's houses, with water, and affording the means for extinguishing fires therein, by the water so raised; 3d, the supplying cities and towns with water; 4th, draining fens and marshes; 5th, for ships; 6th, for draining mines of water; and 7th, for preventing damps in mines.

Dr. Desaguliers, we conceive, ungenerously attacked Mr. Savery's reputation, by alleging that his was not an original invention, and that he was indebted for the first idea to the previously mentioned plan of the Marquis of Worcester. Dr. Rees, with a generous liberality worthy his great critical discrimination, scientific skill, and general erudition, has, we think, ably defended Captain Savery's reputation, by proving his ideas to have originated with himself; we have only an opportunity to notice the most prominent feature in this justification, where Dr. Rees thus expresses himself. "We know that the Marquis of Worcester gave no hint concerning the *contractability or condensation of steam; upon which all the merit of the modern engine depends.* The Marquis of Worcester's engine was actuated

wholly by the elastic power of steam, which he either found out, or proved by the bursting of a cannon, in part filled with water; and not the least hint, that steam so expanded, is capable of being so far contracted in an instant, as to leave the space it occupied in a vessel, and occasion, in a great measure, a vacuum."

The first, and, perhaps, the ablest constructors of this machine, have been Messrs. Boulton and Watt, now Mr. Watt, of Soho, near Birmingham.

Subsequent to the Marquis of Worcester's and Captain Savery's original ideas, and also subsequent to the perfection the Captain had brought his machine to, M. Amonton, a native of France, invented a machine, which he called a fire-wheel; but it does not appear, that it ever was brought to that perfection to be conducive to real utility, although it was certainly very ingenious.

Also M. Papin, a native of Germany, made some pretensions to what he alleged was an invention of his own, only that it happens to appear he was in London at the identical period Captain Savery exhibited his steam-engine to the Royal Society. He, Papin, made some unsuccessful experiments, by order of his patron, the Landgrave of Hesse. We regret that our limits will not permit us to lay before the public, the principles of these two designs.

STEEL.

That steel is produced from the matrices of the same material which yields iron, is a fact generally known, yet its properties are very different from that metal, as may appear from the following enumeration of particulars. It possesses so superior a degree of hardness, that it is capable to cut iron, by filing and otherwise; with vitreous stones it strikes fire: it is a heavier metal; on fracture it has a finer grain, assumes a white brilliant splendour when polished; is susceptible of a greater elasticity; becomes more slowly magnetic, but retains the virtues of magnetical properties longer; it does not so readily acquire rust; when ignited it yields fewer sparks; in the fire it assumes a variety of colours. From many of the preceding peculiar properties, it becomes applicable to a greater variety of purposes than those for which iron is or can be used. However, the cause of this distinction has yet escaped the observation of the intelligent and discerning, in what process it is that the difference is rendered, and they are lost when they come to apply

known names to this procedure. Whether it exist in increase or diminution of carbon, caloric, manganese, molybdæna, or in something else. Conjecture is tired, and so often defeated in its previously formed positions, by observing effects so different in the result.

Without presuming much upon our knowledge of metallurgic operations, we shall just submit a few observations upon the philosophy of the thing,—from principles already acknowledged and generally adopted, which offer themselves to our mind, first premising that we have always understood that at least some portion of the difference between the metals in question, consisted in the labour bestowed; and some other ingredients used in the manufacture of steel whilst it was in process, beyond those employed in iron. With much respect we submit to the superior information of the better instructed, and observe, that as it is a well established fact, that the more labour is employed in attempering mortar, or manufacturing bricks, the more lasting will the former become, and the latter more durable; for instance, there are stock bricks by attempering so well made, that after burning it is with much difficulty they can be broken with the steel trowel of the workmen; they strike fire like siliceous substances; there is at least £2 per thousand difference in the price between them and those of inferior quality,—which occurs from extra labour employed in manufacture. Hence we infer, that the more the metal is welded, and the more attention is employed to established rules in its manufacture, the properties of peculiar minuteness in the fracture, additional gravity, and increased hardness are produced.

The more steel is, according to art, attempered, and the more caution is employed by the manufacturer, so much the more, we submit, must be communicated to it a greater degree of *elastic pliancy* and reverberating power. As to the emission of fewer sparks, that is a phenomenon easily accounted for: as the substance, in consequence of previous labour, has become more dense and compact, that is, it is not so porous as iron; whence the cavities where air is imprisoned, are not so numerous: for we know that to exclude air from any substance totally, is impossible, except indeed by an air-pump: to this impracticability we alluded in a previous article, when we preferred the doctrine of *Descartes* to *Newton* on the opinion of vacuity; as the sparks emitted in fire, are like those pustules which rise to the surface of a of a tea-cup, on a lump of sugar falling to the bottom, and

which particles of air are operated upon by the well-known rarefying property of heat. The difference of magnetic effects in the two metals, we also conceive is to be ascribed to the same simple principles. It is only the difference of colours produced whilst in the fire that we are at a loss to account for; but we suspect this is to be ascribed to certain mineral substances added whilst it is originally making. These our simple conceptions are offered, without looking for words foreign to common-place converse, having used terms which the best informed as well as illiterate will understand.

The invention of steel appears of great antiquity. The Hebrews understood it by no other term than **בַּרְזֵל**, *barzel*,¹ which word served for both iron and steel; they, indeed, distinguished the latter by the additional epithet *Chalybian*, a term indicating, with them, northern, as may be understood from *Ezekiel*, xxvii. 19, according to *Michaelis*.

The name *Chalybs* was given, we are informed, to steel, from the Chalybes, a people on the southern shore of the Euxine sea, between Colchis and Paphlagonia, who had considerable steel mines, which were to the north of Judæa.

Homer also, and other early Greek writers, call it **στομαμα**, though, it is conjectured, this word did not denote the substance of steel so much as it indicated that part of an instrument which was cased or faced with steel; or perhaps it only alluded to the operation of the manufacturing such instruments only.

It also should seem that anciently, in Greece, the name of steel was also *adamas*, to show that Chalybæ² was known to other of the ancients, Greeks and Latins, as a country producing steel, as well as to the Hebrews; we might quote the authorities of *Pollux* and other Grecian authors who have frequently the word **χαλυβδινον** and others, expressive of this material. Hesiod gives us to understand the helmet of Hercules was constructed with it. The poets, also, often speak of adamantine chains, bars, and gates.

Not till a much later period was this name given to one of the most costly of precious stones; in which sense it is

¹ In Buxtorf's Chaldaic Lexicon the term by which both iron and steel is expressed is **אִסְטָמָא**, *istoma*, which is presumed to form the Greek **στομαμα**, which is said to signify steeling or hardening.

In the same Lexicon **כַּרְכֹּמָא**, *carcoma*, is explained by *chalybs*, although the word may mean *æs*, **χαλκος**, which is the Greek **χαλκωμα**, where the *l* becomes *r*.

² It is understood the Romans borrowed from the Greeks the word *chalybs*; but, in consequence of a passage in Pliny, it is believed the former gave to steel the name *acies*, from whence comes the Italian *acciajo*, the French *acier*, which term denotes the cutting part of an instrument, and which in latter times is known by *aciarium*.

not found in either *Homer*, *Hesiod*, *Herodotus*, *Orpheus*, or *Dioscorides*. Though *Homer* has often occasion to enumerate the most costly and rich of ornaments; whence *Goguet* and others have inferred that the diamond was not then known, There is certainly occasion to believe that very valuable stone was anciently called *jaspis*, as many authors, particularly *Dioscorides*, describing the appearance of the diamond, so call it; and it is conjectured *St. John*, in the *Apocalypse*, xxi. 11, 18, 19, means the same substance.

Without going farther into this investigation, which may not be momentous, being rather irrelative, we now come to describe the mode in which steel is at present manufactured, according to the best of our information.

We are informed there are two modes at present employed in the iron districts to procure this article: the first is by fusion from the steel ore; and the second by cementation.

The Celtiberians in ancient Spain employed a very singular method to prepare steel, as both *Diodorus* and *Plutarch* inform us. The metal from which they prepared it, was iron, which they first buried in the ground, and left it in that situation until the greater part of it was converted into rust; the part of it which escaped oxydation, they afterwards forged and made into weapons, particularly swords, with which might be cut asunder bones, shields, helmets, &c. The present process employed in Japan for the same purpose, is similar, and it forms one of the modes recommended by *Swedenborg* for the manufacture of steel.

We are ourselves so little informed of the nature of this metal, that we are inclined to agree with *Plutarch*,³ when he observes that he thinks it is the most perfect portion of iron, and that the ignoble and softer parts have been corroded by rust, the better part of the whole mass, he says, remains thus separated.

We are told by a simile of the poet, in the ninth *Odyssey*, that the burning stake with which *Ulysses* put out the one eye of *Polyphemus*, hissed like the red-hot iron which the

3 Professor Beckmann supplies us with the circumstance which forms this note: "A few years ago, in digging up the floor of a cellar, in an old house, near Göttingen, there was found an anvil, which had lain under the damp earth for many years. It still retained its original form and size, but was become so soft, that it could be crumbled to pieces. When broken, there were seen every where in the fracture exceeding white grains, with a metallic brightness, which resembled polished steel, and were attracted by the magnet, consequently had not been converted into rust."

workmen put into water to harden it. *Sophocles* also uses a similar expression. *Salmasius* likewise speaks of a Greek chymist who taught the mode of hardening iron, as practised in India, as we are informed.

A great deal is said to depend upon the water which was used for that purpose: therefore there were many rivers and springs preferred by different people; in consequence, it often happened that the steel factories were removed far from the iron works for this accommodation. Pliny, as well as Justin, frequently mentions this practice.

It has also been a prevalent opinion that various artificial fluids are good for this purpose. *Vasari* relates an anecdote of the Archduke Cosmo, who in the year 1555, among a large collection of stones, had a block of porphyry, from which he wished a basin to be made for a well, but was told by the most experienced artists that it was impossible to render it practicable; however, the Duke prepared, from certain herbs, a fluid, in which the workmen, having heated their tools, quenched them; and it is said Francesco del Tadda, not only made the required basin, but various other curious utensils.

It certainly appears that *Winckelman* laboured under a misconception where he asserted that *Vasari* said the Archduke of Tuscany had invented a water to make porphyry soft. *Vasari* said no more than has appeared.

With submission to superior information, we conceive, that if any water can have this tendency it may be strong chalybeate, but unite with a learned authority in presuming that much more must depend upon the skill of the workman, than upon any species of water whatever, provided the steel be of a proper degree of heat. It is, we believe, a fact well ascertained among workmen, that the temper of their instruments depends upon this circumstance, of which, however, nothing short of practical experience can supply the necessary judgment.

STOCKING MANUFACTURE,

Comprising Knitting of Nets, Stockings, and the Stocking-Loom.

The invention to which this article refers, affords a warm subject for panegyric. The expression *warm* has no relation to a pun, although it would admit of that spurious species of wit. That clothing for the feet be warm, medi-

cal writers have always advised, and truly upon the most rational, as well as philosophic and experimental practice; the feet lying the most remote of any member from the heart require, and particularly by people in years, to be kept warm, in order for their present comfort, as well as to promote the essential evacuation of superfluous humours by perspiration, without which no frame can be healthy. So strongly is this precept impressed in our national moral habits, that it has formed a general maxim for the preservation of health. Even *Thomas Parr* is said to have observed, upon an inquiry to what cause he attributed the protraction of his life, "To keep the head cool by temperance, and the feet warm by exercise; to eat only when hunger required satisfaction, and to drink only when thirsty."

The art of knitting nets is extremely ancient, as the nets the Hebrews as well as those which the Greeks used, are conceived to be similar to our own. Also, though the art of knitting stockings is not presumed to claim so high an antiquity in the opinion of a very ingenious gentleman, to whom we have latterly been much obliged,¹ and we are happy to confess our obligation for many remarks we propose to transcribe in the present article. It has been thought by *Ovid*, in his sixth *Metam.* that the public were indebted to *Arachne*, (the spider,) for the origin of this ingenious invention; which would, indeed, seem probable, as it appears, that the animal is prompted to be thus ingenious for the gratification of its natural wants, the web serving as a net or gin for the capture of flies and other small insects which supply it with food. And if our memory serve us, we recollect that the poet also, speaking of flies, observes, that the web of this animal, the spider, serves to secure the weak flies only, whilst the strong break it and escape, alluding to the influence of wealth and power to pierce through those laws which were made for the protection of the weak against the encroachments and violence offered by the strong. The author of *Job*, in the 18th chapter and 9th verse, speaks of *gins*. However, in knitting stockings, the operation, as well as the effect, is essentially different from knitting nets. In the latter, the twine is *knotted* into distinct meshes, which are secured by knots; in the former, the entire substance is produced without knots. To this distinction is to be ascribed the

¹ Professor Beckmann.

reason why knit stockings may become unravelled. In the other species, the knots not only prevent the material being taken apart, but they also render the nets sufficiently strong to prevent even vigorous fish from escaping, yet being so capacious as to permit little fish to escape, with the water, &c.

The art of knitting is not now, by any means, so general as it was formerly, then unquestionably rated as it were among the number of female accomplishments; and it is, certainly, rather wonderful, because when the mechanism is once obtained, it requires no exertion of intellect to practise it; it may be continued sitting, walking, and talking, or in almost every other situation to which ordinary life is called; and when it is considered that its produce adds to the comfort of the indigent, to the advantage of the poor,—and that to persons in easy circumstances habitual industry increases their happiness, these things considered, it is with wonder and regret we see it fallen into disuse; particularly as it is an occupation suited to every age and capacity, which the infant is sufficiently strong to practise; and even in the infirmity and weakness of age it is practicable. We certainly do hope and trust these observations may invite the attention of those meritorious individuals who have the direction and management of our national scholastic establishments, to revive the practice.

Fishing nets are also in use among the most barbarous nations at this period, as various navigators have proved; frequently made of rude materials it is true,—some of the bark of trees, and others of the beards of whales, &c.

The Latins called the meshes of the net *texere retia*;² Pliny calls the yarn, or twine, *stamen*.

The art of making nets, or ornaments of fine yarn, is said not to be a modern invention, it having been practised for hangings, and articles of dress and ornament. In the middle ages, it appears, the clergy wore netting of silk over their clerical robes; this assertion is made upon the authority of *Du Cange*.³ Professor *Beckmann* also says, he suspects those transparent dresses were used by ladies more than 400 years ago, to cover those beauties they still wish to be visible.⁴

The invention of preparing coverings for the legs of this species of manufacture, is, we understand, of much later invention. That the ancients had not their legs or feet co-

² As the Greeks say ὑφαντὴν δίκτυα. The Latins likewise call the meshes *macula* and *nodii*.

³ Acta S. Deodati, tom. iii. Junii, p. 871.

⁴ Vol. iv. p. 204.

vered is a fact well established, by proofs of sufficient public notoriety. Indeed the necessity was not so urgent with the inhabitants of warm climates (of whom we have record), as with those in our northern regions, who, we find, generally covered not only the feet, but the legs, thighs, and loins, and often with the same garment. Such there is, we believe, occasion to conclude, were the trews or trowsers anciently worn by the Scotch, but not knit hose, which the following distich is believed to identify:

“ In days when gude king *Robert* rang,
 “ His *trews* they cost but ha’ a croun;
 “ He said they were a groat too dear,
 “ And ca’ud the taylor thief and loun.”

The author to whose direction we submit, says, “ It is probable the art of knitting stockings was first found out in the sixteenth century; but the time of the invention,” he says, “ is doubtful; it is also uncertain to whom we are indebted for this invention.” He continues, “ *Savary* appears to have been the first person who hazarded a conjecture that this art is a Scottish invention, because,” he says, “ when the French stocking-knitters became so numerous as to form a guild, they made choice of *St. Fiacre*, a native of Scotland, to be their patron; and besides this, there is a tradition, that the first knit stockings were brought to France from that country.” This *St. Fiacre*, it appears was the son of *Eugenius*, said to have been a Scottish king in the seventh century; and that *Fiacre* lived as a hermit at *Meaux*, in France; in the Roman calendar, his name is opposite to the 30th of August.

More probable, however, is the opinion in this country, which respectable writers support among them. *Howell*, in his *History of the World*, says, that *Henry VIII.* who reigned from 1509 to 1547, and who was fond of show and magnificence, at first wore woollen stockings;⁵ till by a singular occurrence he received a pair of knit silk stockings from Spain. His son, *Edward VI.* who succeeded him on the throne, obtained by means of his merchant, *Thomas Gresham*, a pair of long Spanish knit silk stockings; this present was, at that time, highly prized. *Queen Elizabeth*, in the third year of her reign, anno 1561, received by her silk-woman, named *Montague*, a pair of knit silk-stockings, and afterwards would not wear any other kind.⁶

⁵ Cloth-hose, *Howell's History of the World*, and *Anderson's History of Commerce*.

⁶ *Howell*, *ibid.*

Stowe also relates, in his *Annals, or General Chronicle of England*, that the Earl of Pembroke, was the first nobleman who wore worsted knit stockings. In the year 1564, *William Rider*, an apprentice of Master Thomas Burdet, having accidentally seen in the shop of an Italian merchant, a pair of knit worsted stockings procured from Mantua, having borrowed them, he made a pair exactly like them; these were the first stockings that were knit in England from woollen yarn. Whence, it appears, that knit stockings were first introduced into England in the reign of Henry VIII. and that they were brought from Spain to this country, and probability appears to favour the belief that they were originally the produce of either that country or Italy. Should this be the case, it has been conceived that they came originally from Arabia to Spain.⁷

The investigation with respect to the feigned productions of Rowley, published by the unfortunate Thomas Chatterton, arose from the mention of knitting in a passage in those poems; it being contended that knit hose were unknown in the days of Rowley. The passage alluded to occurs in the tragedy of *Ella*.

She sayde, as herr whytte hondes whyte hosen were knytinge,
Whatte pleasure ytt ys to be married!

A like ordeal took place with respect to Macpherson's *Ossian*, from a similar reason, the mention of the sun's reflection setting upon a glass window: now the existence of *Ossian* being contemporary with that of Julius Cæsar, it was contended that at that period it was not customary to glaze windows.

The *Johnsonian* faction set about that business in a very unsystematic manner; they should have procured some *Erse* scholar to have gone into those wilds where Macpherson declared he collected his materials from oral traditionary recitals, and have heard the poems themselves from the mouths of the aged inhabitants. If the traces of them could not have been found, they might then have ascribed the superior honour to Macpherson of writing a work that Greece or Rome, in the splendour of literary glory, never surpassed for many poetical beauties.

The good people of Scotland, in the beginning of the sixteenth century, had, in the proper sense of the word,

⁷ Beckmann, vol. iv. p. 299.

breeches; and wore a kind of stockings, their hose coming only to the knees; their stockings were made of linen or woollen, and breeches of hemp.

It is judged these particular articles of dress were also common in England at and after that time, for in the year 1510, Henry VIII. appeared, upon a public occasion, with his attendants, in dresses of the following description: "The king and some of the gentlemen had the upper parts of their hosen, which was of blue and crimson, powdered with castels and sheafes of arrows of fine duckett gold, and the nether parts of scarlet, powdered with timbrels of fine," &c. There may be occasion to suppose the upper and nether parts of the hose were in separate pieces, as they were of different colours. Hollinshed, also, speaking of another festival, says, "The garments of six of them were of strange fashion, with also strange cuts, everie cut *knit* with ppoints of fine gold, and tassels of the same, their hosen cut in and tied likewise."⁷

In anno 1530, the word *knit* appears to have been quite common in England, for John Palsgrave, a French-master to the Princess Mary, daughter of Henry VII. published a grammar, in which he stated that this word in French was applied to the making of nets as well as of caps and stockings.

The household book of a noble family in the reign of Henry VIII. kept during the life of Sir Thomas L'Estrange, Knt.^s of Hunstanton, Norfolk, by his Lady Ann, daughter of Lord Vaux, there are the following entries, whence the price of those articles at that period are ascertained:

1533. 25 H. 8. 7 Sept. Peyd for 4 peyr of knytt hose viii s.

1538. 30 H. 8. 3 Oct. - - - - - 2 peyr of knytt hose - - 1 s.

It is observed, that the first four pair were for Sir Thomas, and the latter for his children.

Nevertheless, in the reign of Mary, *i. e.* May 1558, many wore cloth hose, as is evidenced in the following anecdote of Dr. Sands, who was afterwards Archbishop of York. Being in the Tower, he had permission to have a tailor come to take an order for a pair of hose. This serves to prove the veracity of Stow, that stockings were not an article manufactured in England, generally, we suppose, till six

⁷ Professor H. Boethius's Description of Scotland, found translated in Hollinshed and Harrison's first volume of Chronicles.

⁸ Gentleman's Magazine, 1782.

years afterwards: "Dr. Sands, on his going to bed in Hurleston's house, he had a paire of hose newlie made, that were too long for him. For while he was in the Tower, a tailor was admitted to make him a pair of hose. One came in to him whose name was Benjamin, dwelling in Birchin-lane; he might not speak to him or come to him to take measure of him, but onelie to look upon his leg; he made the hose, and they were two inches too long. These hose he praied the good wife of the house to send to some tailor to cut his hose two inches shorter. The wife required the boy of the house to carrie them to the next tailor, which was Benjamin that made them. The boy required him to cut the hose. He said I am not the maister's tailor. Saith the boy, because ye are our next neighbour, and my maister's tailor dwelleth far off, j come to you. Benjamin took the hose and looked upon them, he took his handle work in hand, and said, these are not thy maister's hose, but Dr. Sands, them j made in the Tower."

In a catalogue of the revenues of the Bishop of St. Asaph, it is stated that, "The bishop of that diocese was entitled; as a perquisite, upon the death of any beneficed clergyman, to his best coat, jerkin, doublet, and breeches. Item, his hose, or nether stockings, shoes, and garters."—*Survey of the Cathedral Church of St. Asaph, by Browne Willis*. London, 1720, 8vo.

About 1577, knitting must have become common, for Harrison, in his description of the indigenous produce of this island, says, the bark of the alder tree was used by the peasants' wives for dyeing stockings which they had knitted.⁹

Hollinshed also informs us, that about 1579, when Queen Elizabeth was at Norwich, "upon the stage there stood at one end eight small women children, spinning worsted yarn, and at the other end as many knitting worsted yarn into hose."

We are informed that the English word stocking, comes from *stock*, *truncus*, Latin, the trunk of a tree. Silk stockings are said, in consequence of their high price, for a long time to have been worn only upon grand occasions. Henry II. of France, wore them, for the first time, on the marriage of his sister with the Duke of Savoy, in 1559.¹⁰

In the reign of Henry III. who ascended the throne in 1575 the consort of Geoffroy Camus de Pontcarre, who held a high office in the state, would not wear silk stockings

⁹ First part of Hollinshed's Chronicle.

¹⁰ Abrégé de l'Histoire de France, par Mezeray, 1696, p. 298

given to her by a nurse who lived at court, because she considered them to be too gay.¹¹ Anno 1569, when the privy-councillor *Barthold von Mandelsloh*, who had been envoy to many diets and courts, appeared on a week-day with silk stockings, which he had brought from Italy, the Margrave *John of Custrin* said to him, "Barthold, I have silk stockings also; but I wear them only on Sundays and holidays."¹² The celebrated Leonard Thurneisser, however, who lived at the court of Brandenburg, about the end of the sixteenth century, wore silk stockings daily; and in general dressed very magnificently in silk and velvet.¹³

The knitting stockings with wires, called *weaving*, has been thought to bear a resemblance to the wire-work in screens of churches. However, the invention of the stocking-loom is thought more worthy of attention, because it is alleged to have been the production of a single person, and perfected at one trial; his name, and the exact period is ascertained; and, because it is founded upon a similar incident to that of the beauteous Corinthian maid, who, as some say, invented the art of painting and design, being traced to one of the most enthusiastic passions of the human heart; also like the invention of pattens, see *Gray's Trivia*. We bestow a particular attention upon this incident which produced the stocking-loom, trusting our fair readers will favour us with their attention when they know it is ascribed to almighty LOVE.

It is a machine which nothing less powerful could have effected we are assured; it consisted of 2000 separate parts. Here the sexual passion produced an humble but very distant imitation of what Divine Love effected in the wonders of the universe.

Under the usurpation of Cromwell, the stocking-knitters of London presented a petition, requesting permission to establish a guild. In this petition they gave a circumstantial account of their profession, (from whence the following particulars are collected,) of its rise, progress, and importance. No doubt can exist but that in this document the petitioners rendered the best, and probably a true account of the origin and progress of their trade, that of stocking-weaving being then scarcely fifty years old. The circumstances they stated being then within memory, any misrepresentation would have militated against them, and could have been

¹¹ Saintfoix Versuch in der Geschichte von Paris, v. p. 41.

¹² Möhsen's Beiträgen zur Geschichte der Wissenschaften in Brandenburg, p. 87.

¹³ Möhsen, ut supra.

easily contradicted. In *Deering's Account of Nottingham* this petition is found. In that town, the loom was first employed, where it has given wealth to many.

Thence, it appears, the inventor's name was *William Lee*, a native of Woodborough, in Nottinghamshire, a village seven miles distant from Nottingham, in which the following passage occurs: "Which trade is properly stiled *frame-work-knitting*, because it is direct and absolute knitwork in the stitches thereof, nothing different therein from the common way of knitting (not much more anciently for public use practised in this nation than this,) but only in the numbers of needles, at an instant working in this, more than in the other by an hundred for one, set in an engine or frame composed of above 2000 pieces of smith, joiners, and turners' work, after so artificial and exact a manner that, by the judgment of all beholders, it far excels in the ingenuity, curiosity, and subtilty of the invention and contexture, all other frames or instruments of manufacture in use in any known part of the world."

The inventor was heir to a considerable freehold estate, and a graduate of St. John's College, Cambridge. Being, it is said, enamoured of a young country-girl, who, during his visits, paid more attention to her work, which was knitting, than to her lover and his proposals, he endeavoured to find out a machine which might facilitate and forward the operation of knitting, and by these means afford more leisure to the object of his affections to converse with him. Love, indeed, is confessed to be fertile in inventions, and has been the efficient passion which has perfected many inventions for which the gratitude of the world is due; but a machine so complex, so wonderful in its effects, would seem to require a longer time than was probably allowed, and a cooler judgment than a lover's to construct such mechanism. But even should the cause appear problematical, there cannot exist a doubt but the real name of the inventor was *William Lee*.

Deering says expressly, that *Lee* made the first stocking-loom in the year 1589; this account has been also adopted by *Anderson* and many English writers. In the Stocking-weavers' Hall, London, is an old painting, in which *Lee* is represented pointing out his loom to a female knitter, who is standing near him; and below is seen an inscription with the date 1589, the period of the invention: *i. e.* "The ingenious *William Lee*, Master of Arts of St. John's College, Cambridge, devised this profitable art for stockings (but being despised went to France) yet of iron to himself, but to

us and others of gold ; in memory of whom this is here painted."

Other accounts make it somewhat later. Thus Howell, in his history, says, it was thirty-nine years after Queen Elizabeth had worn silk stockings, that the loom was invented by Lee. The petition of the stocking-knitters stated that the loom, at that time, had been invented about fifty years. This document bears no date; Cromwell's usurpation existed in 1658. Howell adds, that Lee was as we have stated, and that he taught the art in England and France; his servants in Spain, Venice, and Ireland; and his device so well took, that now in London his artificers are become a company, having a hall and a master, like other societies. Lee instructed his brother James in the use of the loom, and took apprentices and assistants, with whom he carried on business, for some years, at Calverton, a village five miles from Nottingham. He showed his work to Queen Elizabeth; from that princess he requested some assistance, his work having rather embarrassed than assisted him; but she refused assistance or support. Under these circumstances, Lee accepted of an invitation from Henry IV. of France, who had heard of his invention, and promised to reward him for it. He took nine journeymen, and several looms to Rouen, in Normandy, where he worked with much approbation; but the king being shortly after assassinated, and internal commotions taking place, Lee fell into great distress, and died soon after in Paris. Two of his people only remained in France, one of whom was still alive when Cromwell was petitioned, as is previously represented.

SYMPATHETIC INK.

Among those means advised by *Ovid* to young females to deceive their guardians, is to pourtray their sentiments to their lovers in new milk, and for the young men to discover them by rubbing coal dust or soot.¹ *Ausonius* proposes the same to *Paulinus*.² Instead of milk, any colourless and glutinous juice might be employed; such as is

¹ Tuta quoque est, fallitque oculos, e lacte recenti
Litera : carbonis pulvere tange; leges.

De Arte Amandi, lib. iii. v. 629.

² Lacte incide notas; arescens charta tenebit
Semper inadspicias; prodentur scripta favillis.

Ausonii Epist. xxiii. v. 21.

Afterwards other methods of secret writing were taught by the poet.

afterwards taught by the poet, and also *Eneas* in *Poliorceticis*, cap. 31, and by *Gellius*, lib. xvii. cap. 9. There are also several metallic solutions, which when used, are perfectly colourless, until after being washed with another colourless solution, or exposed to certain vapours. But among these, there are none which affords a matter of greater contemplation to the naturalist, or from whence more conclusions are drawn, than from a solution of lead in vegetable acid, by which the arsenical liver of sulphur becomes black, after much lapse of time. This ink may properly be called SYMPATHETIC, being so in itself; whereas, the other previously mentioned are only calculated to amuse the effects of sympathetic feelings in the human species; and the last mentioned species of ink has been doubtless long known to conjurers, and other ingenious legerdemain performers. They doubtless were not unacquainted with the porosity of bodies; as this preparation is so very subtle, that when the liquid is even applied on one side of a board, its effect will be observed on the writing if placed on the opposite side. The first person we find who gave a proper receipt for preparing this wonderful ink, was Peter Borel, in his *Historiarum et Observationum Medico-Physic. Centuriæ quatuor*, printed for the first time in 1653, and at Paris, in 1657, and several times afterwards, where the author speaks of a magnetic water which acts at a distance.³

There is another remarkable kind of sympathetic ink, prepared from cobalt, the writing of which disappears in the cold, but reappears in heat, of a beautiful green colour, and does this as often as is desired; the invention of which is ascribed to a Frenchman, named *Hellot*; it is

³ This wonderful power attached to it is described in his sixth observation of the second century. "An astonishing effect, indeed, is produced by the action of the following waters, which are thus made. Let quick-lime be quenched in common water, and while quenching, let some orpiment be added to it, (this, however, ought to be done by placing warm ashes under it for a whole day,) and let the liquor be filtered, and preserved in a glass bottle well corked. Then boil litharge of gold well pounded, for half an hour with vinegar, in a brass vessel, and filter the whole through paper, and preserve it also in a bottle closely corked. If you write any thing with this last water, with a clean pen, the writing will be invisible when dry; but if it be washed over with the first water it will become instantly black. In this, however, there is nothing astonishing; but this is wonderful, that though sheets of paper without number, and even a board be placed between the invisible writing and the second liquid, it will have the same effect, and turn the writing black, penetrating the wood and paper without leaving any traces of its action, which is certainly surprising; but a fetid smell, occasioned by the mutual action of the liquids, deters many from making the experiment." This, however, the author says, he could obviate, by chymical process in its preparation. He received it from J. Brosson, an ingenious apothecary in Montpelier.

alleged he was the first publisher of it, but not the original inventor. This, he himself, acknowledges, and refers it to a German artist of Stolberg, who first showed him a red kind of salt, which when exposed to heat, became blue; and which he was assured was made from *Schneeberg* cobalt with aqua regia. This account induced Hellot to prepare salts and ink from various minerals impregnated with cobalt. It is, however, said that *A. Gesner* had previously proved that this ink is produced by cobalt alone, and not by marcasite.

Hellot's experiment being made known in Germany, professor *H. F. Teichmeyer*, of *Jena*, alleged he had prepared the same ink six years before, and shown to his pupils in his lectures. It is however said, it was previously invented at the beginning of the century before, by a German lady, which *Pot* confirms, from a book printed in 1705, which he quotes, under the obscure title of *D. J. W. in clave*.

THRASHING-MACHINES.

Thrashing is a term employed in agriculture, consisting of the use of a flail to procure the grain from the husks and straw. This used to be generally done by the flail and hand; however, a machine is now invented, which experience has discovered is to be preferred, upon many accounts, to the ancient mode. Those advantages we shall briefly enumerate; should we oppose, at the same time, the disadvantages of the ancient plan, it is from a conviction of its superior utility.

It certainly should not be said, that because a thing is new, or because that its superiority may not be proved, that it should be rejected; if it offers advantages, it is an unquestionable duty we owe to ourselves, to posterity, to the country, and it is an homage *due* from us to the genius of the inventor, to allow his device to have a fair trial: should all improvements have been thus blindly rejected by our ancestors, we should not have had even the use of the flail; for it was in antiquity the universal practice, as is now the case in many countries, to thresh by the means of the ox. We have innumerable instances of this occurring in numerous texts of scripture, and the writings of the ancient Greeks, Romans, and oriental nations.

If the inconvenience, the waste, and trouble, attending the oldest mode, induced men to adopt the next, the threshing by flail; if these were thought sufficient considerations

for them to relinquish the thrashing by the feet of the oxen; and that it is sufficiently obvious the preceding must have been attended with inconvenience, waste, and much trouble, may be collected from the works of modern British travellers in the south of France, and other places on the north coast of the Mediterranean, where, of late years, the first practice was not discontinued; we are induced to believe, from the circumstances we shall presently mention, that inasmuch as was the second process preferable to the first; so also, is the third to be preferred to the second.

The author of the "Experienced Farmer" observes, that thrashing with the flail is uncertain, even when most carefully performed, for the thrasher may beat a long time, and yet not meet with every head; which, with the machine, it is hardly possible to miss; "and," he says, "the grain wasted by the flail, is certainly great." In short, he gives it as his opinion, that the corn lost by thrashing with the flail, is more than would pay for the thrashing it by the machine, all over the kingdom.

In some places, it is the practice to thrash by measure, as per bushel, quarter, &c.; while, in others, it is done by the thrave, of twenty-four sheaves; and in some by the day.

In whatever way the farmer has this sort of business performed, without his constant inspection, he is continually exposed to the imposition of those he employs. Common precaution, and ordinary care, are not enough to guard him against those little frauds and petty impositions, to which masters are perpetually subject, from the moral delinquency of unprincipled persons they employ, either in purloining small quantities of corn, or from doing their work with vulgar negligence. If it be task work, as it is called, it has been often found that such people will thrash, or pretend to thrash, large quantities of straw, because they have so much per thrave; or if by the bushel, they then will, perhaps, take only the chief of the wheat, &c. out of the straw, because the largest grains will be discharged easier than the less, and fill the measure sooner. In brief, in whatever way a farmer lets this business be done, by the old method, every caution cannot enable him to escape imposition.

Moreover, the flail practice, independent of its being so extremely slow and tedious, is also very expensive, as it of necessity requires a greater number of labourers than can be constantly employed upon small grain farms, or than are often to be with convenience procured; but should the flail practice be continued upon such farms, where, perhaps, workmen may be obtained, and where the expense of

machinery might be thought too great; but even upon such occasions, the horse or hand-machines, which are constructed upon cheap principles, and occupy but little room, may be brought to perform the business in an easy and expeditious manner, and much more efficacious and effectual, as appears from improvements recently made in this sort of machinery; it will probably be to the interest of such farmers to abandon the old method, as the saving in various ways will soon repay their first expense, and, at the same time, afford them a very considerable profit.

Moreover, the thrashing, as performed by the flail, requires very expensive barn-floors, either fixed or moveable; but chiefly of the former, whereas the latter kind will do for machinery; also that the latter sort may sometimes be capable of being removed for other purposes, which may render it useful for other views and intentions, and thereby will it lessen the charge of providing them.

The author of "Practical Agriculture" states, that beyond the superiority of the method by machinery over that of the flail, already suggested, the advantages are numerous in other respects. He insists upon the very superior advantage resulting from the cleanness with which the work is performed, upon the saving in price, and withal with such despatch, as to permit a farmer, in most cases, to be present during its process.

It has been also said, that the flail is a tool only adapted to the most rude and savage state of a people; and which only particular seasons, or in weather of a peculiar tendency, can be used with advantage: whereas, the machine can be equally well employed in any temperature of the air, and when no other sort of work can be done, especially out of doors; and it will employ women and children, as well as men. And, it should not be forgotten, that by its use, the farmer will be enabled to take the advantage of markets to secure the best price for his article, as he has thereby the power of selling and delivering *any* quantity within a little time: and also, by thrashing out, and placing the corn within a dry and secure store-room, or granary, the great loss occasioned by vermin, from keeping it in the straw, may be wholly prevented. Numerous other beneficial consequences may also result from the practice of threshing by machinery, but particularly that of saving the heavy expense of raising and upholding different kinds of buildings, of large dimensions.

It must also be stated, that the writer of the report of the state of the agriculture in the county of Kent, found, upon

experiment of different parcels of straw, of 36 lbs. each, threshed out *clean*, by the flails on different farms, and the same weight of straw, thrashed by the machine, that in the common mode of thrashing, there was half a pint of wheat left in every 36 lbs. of straw, where the flail was used, more than in the same quantity thrashed by the machine.

This is certainly an *important* fact; and as it appears the average was taken, it may be depended upon. Besides that, sufficient supplies of corn may be, as it were, instantly procured for seed, or market, without interrupting the other operations of the farm, as the supernumerary force of women and boys are generally easy to be procured, with less waste of grain, and with less danger of the corn being bruised, which in all cases is disadvantageous to the sample, but in seed corn particularly so. Also, the corn being thrashed out, and prepared for market in a few hours, its appearance in brightness and sweetness is assuredly preserved, and entitled to preference over that which has been lying, perhaps, on the floor for weeks, by the flail method.

Likewise, that from the then increasing scarcity of labourers, (in a time of war,) the great advance in the price of labour, in all the well cultivated districts, and the impossibility of having this work performed in an exact and clean manner by the flail; the necessity, as well as the superior utility of the machine, was established. And it is further contended, that the principal obstacles to machinery of this kind, are chiefly on account of the expense in their construction and erection, and that slovenly practice which prevails in the southern districts, of harvesting the grain crops in an uneven and careless manner. The first of these objections, may, perhaps, be obviated, by the construction of machines for the hand, or one horse or ox; which, it is expected, from the daily improvements made in this kind of machinery, will soon be effected in a complete manner: and as to the latter objection, it surely rests with the farmer to have his work done in what manner he may think proper: he certainly possesses, at all times, the means to correct any bad practices his labourers may adopt in this respect. It is likewise conceived, the objection which has been made to this practice, on the baseless ground of depriving poor labourers of employment, must fall to naught, as experience sufficiently shows, that on a well-cultivated farm there is always plenty of employment, provided it be managed to the best and most advantageous purposes.

To recapitulate the advantages we have enumerated, which we think must accrue to the agriculturist, would be

needless; suffice it to say, that in times of scarcity of labourers, in all times, in all seasons, besides the advantage of saving his corn in quantity, and improving, rather than decreasing it in quality,—without interrupting other necessary employ; and lastly, the rapidity with which he is enabled to send it to market, to secure an advantageous price, may be sufficient reasons to induce any person, not entirely blind to their own interest, to employ the machinery in preference to the manual method. We subjoin the result of some experiments, in point of expense, and then speak of the machine itself.

Estimate of Thrashing, &c. per Machine, for Wheat.

	£	s.	d.
Eight men, at 1s. 4d. each.....	0	13	4
Four boys, at 1s. each	0	4	0
Four horses, at 2s. 6d. each	0	10	0
Cleaning and measuring 24 quarters, at 3d. each	0	6	0
	£1	13	4

This is about half price of the flail method.

For Barley.

	£	s.	d.
Cleaning and measuring 32 quarters, at 3d. each	0	8	0
Other expenses, as above	1	7	4
	£1	15	4

This is a little more than half the price of the flail method, this kind of grain being usually thrashed at 1s. 6d. per quarter.

For Oats.

	£	s.	d.
Cleaning and measuring 40 quarters, at 1d. each	0	3	4
Other expenses, as above	1	7	4
	£1	10	8

This is a little more than half the expense, per flail, being generally thrashed at 1s. 3d. per quarter.

The price of labour, of men and horses, has since been increased in this district.

THE MACHINE.—There appears occasion to believe it

came either entirely from Holland originally, or that the artist who first made it in this country, borrowed his ideas from thence.

It is a machine constructed, we understand, upon the principles of the flax-mills; and capable of being wrought by various powers which have an influence on machinery; as water, wind, steam, or horses; though generally, in this country, they are wrought by horses; we know only two or three which are worked by water; but our knowledge of this kind is very circumscribed.

The grain is beaten, or *swingled* out of the ears, by means of beaters attached to a cylinder, that has a great velocity; this is one principle of construction. By the other, it is rubbed out by suitable means against confined cylinders, which will presently appear.

It should appear, that the machine, since it was first introduced into this country, has experienced wonderful improvements; and, it seems, from what Mr. *Sommerville* says, that nearly on its introduction, a Mr. *Menzies* first improved it. His machine was put in motion by a water-wheel, which put a number of flails in action. This machine executed a great deal of work in a very little time, but from the velocity of its motion, it was soon out of repair; the reputation of the design suffered from this circumstance.

In 1758, another attempt was made by a farmer in the parish of Dumblane, in Perthshire; his machine was constructed upon similar principles to the flax-mills, having an upright shaft, with four arms enclosed in a cylinder, three feet and a half in height, and eight in diameter, within which was the shaft; its arms were turned with considerable velocity with a water-wheel; the sheaves being presented by the hand, were let down from the top upon the arms, by which the grain was beat out, and, together with the straw, descended through an opening in the floor, where they were separated by riddles and fanners, also put in motion by the water-wheel.

We are also enabled to add, that about twenty years afterwards, a third attempt was made by Mr. *Elderton*, near Alnwick, and Mr. *Smart*, of Wark, both about the same time; their machines were so constructed, as to act by rubbing, in the place of beating out the grain. The sheaves were carried between an indented drum, about six feet in diameter, and a number of rollers, of the same description, ranged round the drum, towards which they were pressed by springs, in such a way as to rub out the grain, when the

drum was turned round. Upon trial this was found defective, doing very little work, and also bruising the grain, so as to lessen its value. Upon the previously mentioned designs of his predecessors, Sir *Francis Kinloch*, Bart. of *Glimerton*, a gentleman well acquainted with mechanical powers, who also had paid much attention to rural economy, conceived he could improve such designs he had seen, for the purpose of thrashing. Having seen the last described machine, he thought it would be improved by including the drum in a fluted cover, and to rub out the grain as the sheaves passed between them. This, however, upon trial, was found to fail; it likewise bruising the grain, nearly as much as the model from whence it was copied. In this state it remained for some time; but afterwards was sent by Sir Francis to Mr. Mickle, of Know-Mill, in his neighbourhood, (by profession a millwright,) who, after repeated reflection, perfected a model different to any hitherto practised; *i.e.* by strutches acting upon the sheaves by their velocity and beating out the grain, in the place of rubbing; after much alteration and improvement upon this plan, a model was prepared, approved, and a patent obtained, 1788, since which time, the design has been at various periods improved: but a chief improvement has been that of a screen for the grain to pass through into a winnowing machine. Different machines of various descriptions have been, it is said, lately constructed, to work with chains instead of cogs, and to perform the business in a satisfactory manner. Another improvement is alleged to have been made in feeding the rollers, which is, that of having the upper roller, instead of a wooden cylinder, with rods fixed, an octagon or decagon of cast iron, divided into four parts, loosely joined together, so as in turning round, each can rise or fall in a separate manner, according as the corn is spread thicker or thinner. The advantage of which is, that by means of this contrivance, the corn is regularly held; whereas, by the roller being all of one piece, if at one place the grain should be more in quantity than at another, the whole roller is raised, and the grain passes through without being held to be sufficiently beaten.

Upon various principles different machines have been constructed, which have had the test of experiment, in order to observe which would produce the most beneficial effects on the work; and such numerous improvements have been made, as would require volumes for mere description.

The greatest improvement we think we notice, is in a

machine constructed for the Hon. *Newton Fellowes*, in Devonshire; this is, and must be, of necessity, very complex, when we understand that it performs the various operations of thrashing, winnowing, grinding, and boulting, at the same instant, with complete success. This machine is worked by water, and is capable of discharging 35 bushels of wheat, and nearly 40 of barley, or oats, per hour.

Mr. Fellowes's machine is usually conducted in its operations by three men and two women, for unbinding the sheaves and filling the rollers, which are grooved, in lengths of six or eight inches. On the straw being discharged, a person attends to shake it over a large open screen, where another person removes it away, being thrown over to him: at and under each of the winnowing machines, sieves are placed to receive the grain coming from the machine, then conducted into the trapper of the fan of the second winnowing machine; thence it is received into another sieve, which either discharges it into the trapper for grinding, or for the market, or other purposes; in passing through this little fan, a separation takes place which effectually divides the head from the tail corn. A cylindrical pearl barley apparatus is applied to cleanse the corn from smut, and by taking off the downy end of the grain, a much finer sample of wheat and flour is obtained; and for seed corn is infinitely more beneficial; because it takes off the down from the end of the grain, which contains the smut, as well as the germ of insects, which often prove its destruction whilst in the earth. This certainly appears to be a most able piece of machinery. In various districts, where straw is valuable on account of manufactures, machines are constructed which separate the heads of the corn from the straw, so as to preserve it whole.

The grand principle, we think, which should be observed in the construction of all kinds of machinery, is to endeavour to have such simplicity observed, as may be consistent with efficacious operations; and certainly, in all machines meant for universal benefit, to have them constructed as economically as possible.

TIN AND TINNING.

The name of this valuable mineral in the Hebrew writers, *Isaiah*, *Ezekiel*, and others, where it occurs, is *בְּרִיל*, *bedil*; in Greek, it is called *κασσίτερος*, *cassiteros*; the Latins called

it *stannum*: whence the derivation of those words we often use, *Cassiterides*, for the Cornish coast and Lizard Point, occurs in our geography; and the Court of *Stannaries* in our legal institutions.

A certain eminent writer suspects *tin* is not so ancient as those innumerable authorities we possess will prove, and many which himself has quoted establish its existence to be. He thinks the ancients must have meant some other kind of metal; although he certainly does not define any which could have answered in every particular for that metal under consideration. He says, "The *stannum* of the ancients was no peculiar metal; at any rate not our *tin*, but rather a mixture of two metals:" by way of supporting this chimerical notion, he cites a passage of *Pliny*,¹ which, in the same breath, he confesses he does not understand.² Assigns as a reason, "because we are not fully acquainted with the metallurgic operations of the ancients, it is not sufficiently intelligible." Eventually he comes to the conclusion, that "the *stannum* of the ancients was not our tin, nor a peculiar metal, but the *werk* of our smelting-houses." It may become a question worthy of inquiring into, but easy of solution by a plain and simple interrogatory, whether there ever has been discovered any metal, or metallic compound, either produced by the ingenuity of man, or occasioned by accidental association, which was found to answer all the purposes, or any particular occasion, for which *tin* is indispensably requisite? Because it follows, we submit, should this have been the case, that the Phœnician merchants, the Greeks, and others, known to have visited this country in the remotest ages for that article, would have procured it, without taking so long a voyage as they did from Asia to Cornwall, for that article.

The paucity of that article sufficiently accounts for the value the ancients placed upon it: *Homer* considered it next to silver. The poet tells us that *tin* formed the armour for the legs and ancles, called *greaves*; thus was Agamemnon accoutred,³ and with this was Achilles armed.⁴ We also learn, that it was occasionally the practice to ornament the chariots of princes with this metal, and, we presume, instead of silver, from the circumstance of its being classed with the noble metal, gold. Thus were the chariots of Diomed ornamented.

¹ Lib. xxxiv. cap. 16, 47.

³ *Iliad*, lib. xi. v. 24.

² Beckmann, vol. iv. p. 8.

⁴ *Ibid.* lib. xviii. v. 707.

Ἀρματὰ τε χρυσῷ πεπυκασμένα, κασσιτέρῳ τε.

“ Chariots richly adorn'd with gold and tin.”

POTTER.

It is a metal that appears peculiarly applicable for that purpose, being recommended by the union of those two rare qualities found in one article, strength and lightness.

Britain is the only place, except India, where we recollect reading that tin is produced. With respect to the Indian tin, the passage to which we allude occurs in the 3d chap. 2d book, of *Diodorus the Sicilian*, in his general description of India. He says, “As the earth is fruitful in producing all manner of pleasant fruits, so in the bowels of it are to be found all sorts of metals; for it abounds with mines of gold, silver, brass, iron, and *tin*.” Notwithstanding India yields tin, the Chinese purchase large quantities of British tin; it being known to be the only article they buy or take in exchange for their tea and spices of the India Company, except scarlet rags, from which they extract a rich carmine colour. The Phœnicians need not have come to Cornwall for tin, had they known it could have been procured in Spain, as has been surmised, or in India, with the entire produce of which country we are convinced *Diodorus*, and many of the ancients, were well acquainted.

However, without presuming to direct the judgment of others, we give only as our *own* opinion, when we say, we believe the ancient Tyrian *cassiteros* was the same metal we now call *tin*.

Tinning.—It appears the ancient Romans employed the material they called *stannum*, for the same purpose we now employ tin, for lining stronger vessels, generally of copper; *i. e.* such vessels in which saline acid, or oily substances were put, or prepared in cookery, &c. Because such liquids readily acquire a smell and taste when boiled in copper vessels. And they are generally attended with more fatal consequences. We cannot forget the accident which occurred some years ago to a whole company, who dined at the Crown, at Salt-hill, from eating what had been boiled in saucepans without this precaution: that they *then* dined for the last time.

Unquestionably to be much admired is the providence of Heaven, that has placed so trusty a centinel to the stomach, as is the nose, for its protection. We observe that this organ supplied the ancients with instructive precaution to avoid the fatal poison of verdigrise, perhaps previous to their ascertaining its dreadful nature from actual experiment;

for the benefits which the moderns enjoy of admired chymical analysis, they were not unacquainted with.

The passages in *Roman* authors, which have reference to the practice of tinning, are the following: *Pliny*, lib. xxix. 2. § 20. *Ibid.* lib. xxx. 5. § 12. *Columella*, lib. xii. 41. p. 805. *Vegetius*, i. 16. p. 1050. *Apuleius*, *de Asino aureo*, p. 841. *Palladius*, lib. vi. Maio. 7, p. 958. *Scribonius Largus*, *Composit. Medic.* edit. Rhodii. Patavii, 1655, 4to. § 230, p. 115: § 268, 269, 271. *Plin. Valer.* lib. i. cap. 31, lib. iii. cap. 2. and *Marcellus Empir.* cap. 21, with others. *Dioscorides* also has noticed it in ii. 84. p. 109.

The Romans, it appears, at first used for this purpose silver, or else more latterly they substituted tin in its stead. It appears from *Pliny*, that in his time, tin was equally mixed with lead, and called *argentarium*; it may be probable, that it was with this metallic substance they covered the interior of their *vasa stannea*, as they called those vessels which were so prepared.

There is a passage in *Pliny*, which Professor Beckmann says has been left untranslated, in which that author says, *improbiores ad tertiarium additis aquis partibus albi, argentarium vocant, et eo quæ volunt, incoquunt.* By which, Beckmann says, he seems to reproach those who melted together equal quantities of *tertiarium* and pure tin, and then gave it the name of *argentarium*, as if it had been of inferior quality to the *argentarium* first named. But as equal quantities of *tertiarium* and pure tin, he conjectures, produced a mixture, in which for one part of lead there were two of tin, how then, he inquires, could those who made this mixture be called *improbiores*? He proposed to answer it, by conjecturing that *Pliny*, perhaps, meant to say, that tinning properly should be done with pure tin, but that unprincipled artists employed for that purpose, tin mixed with lead. *Galen*, he also adds, gives cautions against the use of tinned vessels, in *de Antidotis*, i. cap. 8, which caution must unquestionably have arisen from the admixture of *plumbeo* with the proper *stannea*; and, indeed, in this passage *Galen* says, *stannum autem plumbo adulteratur*, which clearly tends to establish Professor Beckmann's previous opinion. *Galen* accordingly advises people to preserve medicines in glass vessels, or gold.

Of the process of tinning employed by the ancients we have no definite account. *Pliny* is the only author who appears to have noticed it, and he describes it only in general terms: his words are *incoquere et incoctilia*: these words

appear to announce that it was performed by a similar process to that at present used to tin our iron wares, by immersion in fused tin. Thus it appears to have been executed in the days of *Pliny*, who says it was done in a perfect manner, and that vessels newly tinned could be scarce distinguished from silver; and although we suppose there is scarcely any ore which is heavier than that of tin, yet after the metal is extracted, the metallic particles are amazingly light, inso-much so, that *Pliny* appears surprised the weight of the vessels, in consequence of the process, should be but little increased. This is the case at present, when the work has been skilfully performed. The late very scientific and eminent prelate, *Dr. Watson*, caused a vessel to be tinned, which weighed before the operation 26 oz.; after it, the weight was increased only half an ounce. This vessel measured 254 superficial square inches. This, therefore, affords another proof of the almost infinite divisibility of metals which are the least porous; here half an ounce of tin covered 254 square inches.

It does not appear, however, that the Romans employed the process of tinning where we should think it most likely to find it, in their kitchen and household furniture; at least, such does not seem common among them. Those who have treated expressly of the art of cookery, have been silent on this head, even when speaking of salted provisions. This tends the more to excite our wonder, because they generally employed copper vessels; whence it appears they did not think them injurious: the formerly cited observation of *Pliny*, on this head, only goes to the recommendation of tinning, in order to prevent the *disagreeable* flavour of copper: he does not observe that the health was injured by the pernicious influence of verdigrise. Neither do any of the ancient physicians observe so, they, as we have seen in *Galen's* opinion, were truly conscious of the poisonous properties of lead. As the *stannum* used to be amalgamated therewith, this must have given occasion to the previous caution of that physician.

It is no less remarkable, that among the numerous vessels discovered at Herculaneum, there were no *tinned* vessels. The greater part of them were of copper, or entire *stannum*, few of which were silvered, and none of them tinned.⁵

⁵ *Recueil d'Antiquités*, par Caylus, i. p. 269, and v. p. 291; also Winckelmann said so before him; as did De la Lande, in *Voyage d'un François en Italie*, p. 120, and others, have borne evidence to the same effect.

The invention of tinning vessels is ascribed by *Pliny* to the Gauls; he particularly extols the *Bituriges*, the ancient inhabitants of the province of Berry, and appreciates those articles then manufactured at *Alexia*, or *Alegia*, thought to have been *Alise* in *Auxois*; he also speaks of their only tinning copper; from his account, it is said, not only *tin* was used, but *stannum*.

The same author has asserted, in another place, what appears to moderns to be a fact; he says, tin cannot be soldered without lead, nor lead without tin. Those metals are understood to fuse more readily when together, than either will when separate; the fusing point of tin is 447° , *Fahrenheit*, whilst that of lead is 612° of same, ascertained by *Wedgewood*. And in the stead of oil, mentioned by *Pliny*, as used by the workmen in this process, they now employ *colophonium*, or some other resin.

It should seem probable, from what appears to have been proved, that the Romans, whilst they possessed this island, prepared vessels of molten tin. These have been since discovered in Yorkshire and in Cornwall, with Roman inscriptions.⁶

In the thirteenth century, Henry III. gave as a present a *stagnarium*, *stannaria*, or, as has been said, a *fodina stanni*. This monarch also established in the next century the *stannarium curia*, or Court of the Stannaries, a court for the settlement of disputes among the miners, and for the regulation of the Cornish mines, now vested in his Royal Highness the Prince Regent, as Duke of Cornwall.

In a sumptuary law of the same century, it was forbidden to the clergy as a species of ornament they were fond of, called *lunulæ stanneatæ*. In a catalogue of the year 1379, the following articles occur: *tria parva stanna modici valoris* - - - *item unum stannum parvum* - - - *item duo magna stanna*.⁷

It has been alleged, that Spain had mines of tin, which ceased to be worked on the arrival of the Moors. Whether this be true we cannot vouch. It appears that England enjoyed the tin trade exclusively till as late as the thirteenth century, when mines were said to have been discovered in Bohemia; these works are said to be older than the Saxon. It is certain that *Hagec*, in his *Böhmische Chronik*, asserts, that the Bohemian mines were discovered as early as 798.

⁶ Philos. Transactions, 1759, with figures given. Likewise in Whitaker's History of Manchester, London, 1771.

⁷ Proof of this is found in Dufresne.

This, however, has been questioned, and appears without foundation.

Matthew Paris relates, that a Cornish man having fled to Germany on account of a murder, first discovered tin there, in 1241. He even adds, that the Germans afterwards could furnish this metal at so cheap a rate, that they sold it in England, on which the price fell there very much, to the great loss of Richard, the Earl of Cornwall, who also was elected King of the Romans. In this his relation, *Matthew Paris* has been followed by most historians and annalists: he relates it as an event which occurred in his own days; therefore we may not be justified in doubting the truth; though it has been observed, that the incident is not mentioned by any of the Bohemian or German annalists, chroniclers, or historians.

The art of tinning plate-iron, appears to have been invented either in Bohemia or Germany, but the period is not known: thence it was communicated to England and to France. *Yarranton*, an English writer, says, the first tinning of this description was invented in Bohemia; that a Catholic clergyman, who embraced the Lutheran religion, brought the art, about 1620, to Saxony, since which time, till the period he wrote, 1698, Germany supplied all Europe with tin-plate iron.

From about 1670, a company established in England, sent the before-named *Yarranton*, as an ingenious man, to Germany, to learn the art of tinning, who having there attained it, returned with some Germans to England, manufactured tin-plate, and met with much success. Before this company, who had been at the expense of procuring this information, could effectually carry their plan into execution, it is reported that a person of some distinction, having made himself acquainted with *Yarranton's* process, procured for himself a patent for the invention; no use, however, was made of this patent so dishonourably obtained.

About the year 1730, tin-plate is said to have been manufactured at Pontypool, in Monmouthshire, which, in colour, splendour, and pliability, exceeded all foreign articles; as to the date, it has been doubted, but the effect has been confessed.

Under the administration of *Colbert*, who procured workmen at Chenesey, in Franche-Comté, and others at Beaumont-la-Ferriere, in the Nivernois, this manufacture was introduced into France. Some manufactories were established at Mansvaux, in Alsace, anno 1726, followed by

another at Bain, in Lorraine, which obtained its privilege from Duke Francis III. confirmed by Stanislaus in 1745.

In modern times tin has been brought from the East Indies to Europe: we know not when this trade began; however, it appears to have been as early as the beginning of the sixteenth century. Louis Barthema was then in India, and he speaks of Malacca tin. F. Mendez Pinto was there in 1537, as was Odoard Barbosa, in 1516, who mentions that it was carried from Caranguor to Malacca. Munster, Mercator, and old geographers relate, that before the Portuguese settlements in India, large coins of tin were in circulation in the island of Sumatra.

The greater part of Indian tin comes from Siam, Malacca, and Banca. In the last-mentioned place, is an island on the south-east coast of Sumatra, the mines there are reported to have been discovered in 1711. At present, there are ten mines, worked by Chinese, on account of the King of Palimbang: 125 lbs. cost him only five rix dollars; for this quantity he receives from the Dutch East-India Company, to whose dominion he is subject, from thirteen to fifteen dollars. The greater part goes to China, or is used in India.

In 1790, the price of British tin rose in Cornwall, from 58s. to 72s. per cent. from an export to India of 1200 tons.

VELOCIPEDÉ.

Equi-ambulopeïd, Lat.; τετραπῆς ἐππος, Gr.; *Hobby*, Eng.

There have been numerous curious and many useful productions of human ingenuity; whilst there are some, which from curiosity, and, perhaps, whimsicality, are calculated to attract public attention for a short period only.

Of this latter description, we are inclined to believe the article under consideration is to be classed; observing, that we hope our own sentiments may be ever found to accord with the rational feelings of our species, which are directed, generally, by the finger of utility.

However, of the article under our present consideration, we must not fail to render to the ingenious inventor our portion of admiration, by observing, that it is a machine, which for simplicity of principle, we conceive will be obviously apparent, by the suggestions to be collected from the *specification* of his patent as follows.

The patent for this machine was obtained by Mr. J.

Johnson, coachmaker, of Long-acre, who calls it the Velocipede, or swift-walker.

This machine, we are told, was the invention of *Baron Charles de Drais*, master of woods and forests of his Royal Highness the Duke of Baden. The inventor gives, we understand, the following account of the principles upon which the invention had existence.

Its theory is founded upon the application of a wheel to the action of a man in walking. As it has reference to *the economy of power*, the present invention may be compared to that very ancient one of carriages, as the horse draws in a well constructed carriage, both the carriage and its load, much easier than he could carry the load upon his back. So it is argued the velocipede enables a man to walk on a good hard road, with the expedition of a horse's common gallop, or, we should think, *canter*; that he can ascend a hill as fast as a horse can walk, and that upon the best roads, his pace will be equal to the swiftest course of the horse.

The machine consists of a pole, upon which is affixed a seat, or saddle, for the rider, and a bar in front for him to rest his arms upon, while directing the fore-wheel, which is moved upon a pivot, like the wheel of a common garden-chair; behind there is another wheel, moving upon an axle-tree. The peculiar benefit of this appears to be, that the rest afforded to the velocipedist between his steps, which sets the machine in motion, enables him to proceed much quicker, and to continue his exertions much longer, than he could possibly do, were he to support himself upon his ancles.

The Rev. Dr. Schwaabe hath informed us, that he recollects having seen this instrument in a friend's garden in Germany, two years previous to its appearance in England.

ULTRAMARINE.

ULTRAMARINE is an Asiatic production, and is the name of a well-known colour, prepared from a stone called *lapis lazuli*, found in the mountains of *Bucharian Tartary*, particularly at Kalab and Budukschu, eastward from the *Caspian* sea, whence it is carried to India, and from thence imported into Europe. Although this stone was known to the ancients, it is supposed they called it by another name; it has been judged by some it was their *sapphire*, as its appearance is

said exactly to correspond with that stone, so often mentioned in the scriptures and the works of the ancients. If ultramarine received its present name about the period of the decline of the Latin tongue, as has been conjectured, for *ultramarinum* is a name which does not appear in any of the classic writers, it seems to have been given to distinguish it, because it was an object procured from *beyond the seas* to most European nations: it has also been called *transmarinum*. The *lapis lazuli* has been heretofore thought to have been impregnated with gold, from those particles of yellow colour usually found intermixed with its substance: hence, we are told, it has been occasionally by some writers classed among the *ochres*.

M. P. J. von Strahlenberg, in his *Historio-Geographical Description of the North-East parts of Europe and Asia*, relates, in p. 399, that at *Kongur*, they find a sort of inferior *lapis lazuli*; but, he says, in the province of *Dauria*, near *Arzun*, he was told, there is some that is fine; though he had not seen it.

Naturalists have hitherto believed it to be coloured by *copper* particles; however, it is now considered that the colour is imparted to it by *iron*. Should this be the case, we cannot help observing the many variegated hues that useful and intrinsically valuable mineral gives; thereby rendering it as much an object for admiration to the naturalist, as it is of unquestionable utility to the general world!

The ancients also called it sapphire: under this name it will be recognised in the scriptures, from the description of the breast-plate of Aaron, in the 28th chapter of *Exodus*, to the period of the visions in the *Apocalypse*, of the hermit in *Patmos*.

The mode of its preparation, to assume the name which heads this article, is by selecting the purest parts of the stone, which are its deepest and rich azure tints, free from its gold coloured particles, and pulverizing them to impalpability. Then there is some other process, which the preparers of it have concealed from us; although, it is said to be found in *Speilman's Institut. Chem.* p. 45, but not having access to that work, we cannot insert it. But, it appears, that the impositions are so frequent in this article, upon account of its great price, even in the very country where the original stones are procured, that the following criterion to try its value by its genuineness, will not be considered as unacceptable. It should be of a deep blue, of the colour of a flower, called the *corn-bottle*, perfectly free from sand and

every other admixture; this may be ascertained; first, by careful inspection; and, secondly, by rubbing it on a slab with a knife; it should mix readily with oil, and, when dry, stand its colour when put upon a red hot plate of iron. It should dissolve in strong acids, like the *zeolite*, without producing any effervescence. Those precautions are essential; as there are so many substances imposed upon the public, in the room of the genuine article, sometimes cobalt; often the powder of the Armenian stone, which is a calcareous stone, tinged with copper; often blue jasper, sometimes blue sparry fluor, mountain blue, or *malachite*. It is a pigment that will withstand heat, cold, or any constitution of the climate; it may, therefore, be exposed without danger of receiving any injury. Of its durability the public may judge, when they are informed that the iron-work, in the windows of the Goldsmiths' Hall, London, is painted with *ultramarine*, being a present made by King Charles II. to that company. And, truly, of all substances, there is none which has a greater sensibility to the operation of atmospheric effects than has iron; and although some centuries have elapsed, the colouring in question is yet as fresh as though it were painted only yesterday.

It is, we believe, pretty well ascertained that the *lapis lazuli* was never employed by the ancients as a paint; they chiefly applied it in trinkets and for Mosaic work; it has been even said, that notwithstanding its excessive value, such was the luxury of Rome, that there have been, occasionally, steps to staircases made from it; but such is now, and has been for many years, its scarcity, that none of a magnitude sufficient for that purpose can be procured. The *Bucharians* themselves cannot procure a scantling of it of above a pound weight. In the year 1769, an ounce of the genuine *ultramarine* was sold in Paris for *four pounds sterling*. It is conceived that *cobalt* is better calculated for enamelling than *ultramarine*.

ZINC.

Zinc appears to be one of those metallic substances which neither the Greeks, Romans, or Arabians knew by its present denomination. A chief reason for this belief exists in their not having left us its chymical character. We are also without any name left by them, answering to its description. *Grignon*, indeed, pretends that he discovered

zinc in its metallic form, among the ruins of an ancient Roman city in Champagne; but as it has been conceived that a sufficient attention was not paid to this remain, to ascertain its properties, his assertion has been regarded as made without sufficient authority.

This is, we understand, a metal which has never been found pure;—its chief component is generally mixed with ores of several descriptions. This reflection may excuse the ignorance of the ancients respecting it.

Even when we reflect that its principal component parts are generally found mixed with other ores, which abound in zinc; when these are melted, it becomes sublimated in its metallic form, and is found adhering above, like scum, to the cooler part of the furnace. Let it be observed, that zinc requires 700° of Fahrenheit, to produce fusion. But, when it is found so associated, we need not wonder it escaped the most accurate observation of the ancients, considering that they were not so conversant with mineralogy, and those secrets of nature which chymistry and alchymy have unfolded to the moderns. In fusion, a particular kind of apparatus is necessary to save it, else its more valuable part evaporates, and the grosser substance is partly calcined appearing like an earthy crust, exhibiting no metallic semblance whatever.

The mixture of zinc and copper, in various proportions, which forms the metals called *pinchbeck*, *princes-metal*, *brass*, *tombak*, &c. were first discovered from ores abounding in zinc, which yielded, when melted, not pure copper, but brass, occasioned by the admixture with that metal, with which the ancients, in the earliest periods, if we believe Homer, were intimate.

Mines containing ores, from whence, to use his sentiment, *yellow brass* was obtained, were held in the greatest estimation; when those were once exhausted, they supposed the like would never be found again.

However, in process of time, it was remarked, although, from want of records, no memorial of the period or circumstance is preserved, that an earth, which must have been *calamine*, when added to copper whilst fusing, gave it a yellow colour. This earth was therefore used, and which has been remarked by *Aristotle* and *Strabo*, among the ancients; and by *Ambrosius*, Bishop of Milan, *Primasius*, Bishop of Atrium, and *Isidore*, Bishop of Seville, in the fourth, sixth, and seventh centuries, all of whom have spoken of this earth.

It is conjectured the name by which the ancients distinguished the calx which produced copper was *cadmia*, by which they meant to distinguish a mineral abounding in zinc, as well as with what we now call *calamine*; and if by the latter name, in the entire sense, they embraced the epithet *cadmia*, the complete sense of many of their passages must be lost to the moderns.

It is highly probable that ore containing zinc, first obtained this name because it yielded brass. Afterwards they observed calamine gave to copper the same appearance and effect, they called this yellow colour the same also. They, however, had not much of it. The mines which chiefly produced it, and which were at the same time eminent for yielding a good article, were in Cyprus; they originally called it by that name, *i. e. æs Cyprium*; after that, it is found changed to *cuprum*. It has been observed, that the oldest writer who used the latter word, was the biographer of *Caracalla*, in that prince's life.

Pure zinc earth is said to be used by our physicians for certain purposes in medicine; but it is, we believe, more commonly employed by surgeons; they know how to make choice of the pure and good earth, but our smelting houses use any kind of it, indifferently. Calamine is of many species, and it has had a greater variety of names than almost any known substance. The German mineralogists call *calamine*, as well as what the ancients call *cadmia*, by the name of *ofenbruch*; the ancients also named it *calimia*, and modern Greeks call it *kelimia*; the Arabians denominated it *tutia*; *thouthia*, say the Greeks, and *pompholyx*; and the Latins *lapis calaminaris*,—all expressing the name of a mineral containing zinc. Those names they sometimes applied to the furnace-calamine.

Zosimus has left a receipt for preparing brass, which it is said, has been given by writers on mineralogy ever since his day. He says, that in order to make brass, Cyprus copper must be melted and pounded, *tutia* must likewise be strewed over it. *Saumaise* says, he suspects that *Zosimus* only meant *calamine*. But, whatever the best informed can offer upon this subject, appears not to exceed conjecture; therefore, we shall content ourselves by noticing such principal facts as have come to our knowledge.

It appears that *furnace-calamine* was first employed for making brass in the way previously mentioned by *Zosimus*, who is supposed to have written in the fifth century; eleven hundred years afterwards, it appears to have been first

used at the German smelting works, *Erasmus Ebener*, having first shown the German mineralogists that it might be so employed instead of native calamine.

About this period, Duke Julius, of Brunswick, to whom Ebener, who was of a noble family, was a privy-counselor, much improved the art of mineralogy in Germany, by having been the occasion of this last-mentioned improvement; also, because that potentate, the Duke, we are informed, endeavoured to improve every branch of the manufacture of metals, copper in particular, under the fallacious hope to discover the long concealed secret which absorbed the attention of alchymists. It is even said this noble person actually invented and prepared, from zinc, white vitriol; although we know it has been alleged that this powerful drug was invented, or produced accidentally, long before that period, even before it was known that this semi-metal afforded it. But it is agreed that it was known before this period, when it is said it was first manufactured at Rammelsberg, by a citizen of the name of Henni Balder.

As the previously ascribed properties appear to be peculiar to zinc, they have been noticed.

CONCLUSION.

Thus we have at length attained the point for which we started.

In the *first* place we beg to observe that it may be expected we should anticipate our own imperfections; this we certainly do to the full extent, and further, if it were possible, even than the contemporary enmity of nibbling criticism can aspire; and by way of apology for our not considering every thing which should appear in a work of this nature, we beg to observe, that we are fully conscious of the omission of numerous articles which should have been embraced; but it was utterly impossible to include every thing worthy consideration within the limits assigned us, the subject embracing so extensive a circle as to include nearly the whole periphery of human knowledge. But our idea, and also that of our publisher's, was to comprehend as much of useful matter as possible within a moderate compass, and a consequent low price, so as not to prevent any from obtaining at least a general view of what has been effected by the labours of our predecessors to promote general comfort,

and thereby to attain universal happiness. We add, that whatever may be found deficient in this respect, the favour of the public may enable us to correct and amend in any future volumes by way of continuation.

In the *second* place, we intreat to notice, that whatever is done, we are conscious is not so well done, but what better qualified hands might have executed much, nay, infinitely better; have more scientifically arranged, learnedly handled, and systematically explained. But of this, we assure the public, no attention, on our part, was wanting, to the best of our very humble ability to speak of those things to the utmost of our understanding.

Thirdly.—Whatever appears which is our own, and delivered as our individual property,—we are answerable for; trusting and hoping we have not offered a violation to science, or offended those laws which regulate the social harmony of humanity; and for whatever appears that originally belongs to others, we have to offer the amplest testimony of our sense of most sincere gratitude for numerous favours of this description: we confess now generally, as we believe we have done so individually as they occurred; not being desirous to obtain more than our due, or to arrogate what belongs to others. Should the imputation of literary speculation be found to attach to us, we have to offer a few words, by way of extenuation. It will, in a primary view, be recollected, that *our labours are for the public*; our respect for them compelled us to adopt whatever appeared pertinent to our subject, that we might render our exertions as serviceable as possible; but yet, should literary appropriation be charged upon us, if we could not justify this by the previous observation, we may be permitted to plead the precedent of many noble and learned predecessors, who have taken similar and much grosser liberties with those who have preceded them. Among ancient plagiarists appear the respected names of *Pliny*, *Eliau*, and *Athenæus*. To specify particular instances, *Justin* borrowed all his works from *Trogius Pompeius*; *Julius Solinus*, in like manner, transcribed from *Pliny*; so did *Lucian* and *Apuleius* from *Lucius Pratensis*; both men living in the same time, and both transcribing the same author in their famous books, entitled *Lucius* by the one, and *Arcus Asinus* by the other. In precisely the same manner hath *Simocrates*, in his tract *De Nilo*, dealt with *Diodorus Siculus*, as may be observed in his work annexed to *Herodotus*, translated by *Jungermanus*. That the very eminent *Eratosthenes* wholly translated *Timotheus de Insulis*,

not even reserving his preface ; this, *Strabo* reports of *Eudorus* and *Ariston*, in the treatise *de Nilo*. *Clemens Alexandrinus* hath observed many examples of this nature among the Greeks ; as also *Pliny* confesses the same fact in his preface, that in those authorities he found necessary to consult, he frequently discovered only mere transcripts, often verbatim, without that token of honesty or acknowledgement to whom they were indebted for the thought.

Even the most accomplished of poets, who had wit and invention at will, are also observed to have been guilty of this impropriety,—injustice, it may be called, if you please ; for *Ovid* is charged of this theft upon *Parthenius Chius* ; even the judicious, the immortal *Virgil* hath not escaped this censure, his *Eclogues* being taken from *Theocritus*, his *Georgics* from *Hesiod* and *Aratus* ; his *Æneids* from *Homer* ; *Macrobius* observes that the exploit of the *Trojan* horse, is derived almost verbatim from *Pisander*.

The sons of *Æsculapius* are not free from this imputation, for *Oribasius*, *Ætius*, and *Eginetta*, have all copiously transcribed from *Galen* ; *Marcellus Empericus* hath left a famous work, *De Medicamentis*, which was all literally transcribed from *Scribonius Largus*, *De Compositione Medicamentorum*, not even sparing his preroration.

To name no more, individually, we observe even our modern *Cyclopædists* and *Encyclopædists*, from the very nature of their undertakings, must borrow much matter. Indeed, in works of the nature of theirs, and also of our own, it is next to impossible to avoid falling into such practices. All who possess the benefit of feeling for the wants of contemporaries and posterity, are desirous to deliver such truths which bear the impressions of the currency of the world, and which are stamped with its approbation.

Pope hath observed, excellently, in his preface to *Homer*, and thence he hath proved the excellency of the invention of his immortal prototype, that in works of taste, as oratory and poetry, *invention* is the chief and most eminent characteristic of *genius*.

Although ingenuity is peculiarly serviceable to science, yet it is not for all who may have a taste that way, to possess the rare faculties, the peculiar gifts, of a *Descartes*, *Newton*, or *Boyle*.

But to finish Mr. Pope's observation: "Invention furnishes art with her materials; without it, judgment itself can but steal wisely."

The only claim, on the score of merit, which a work like

this can assume, is in the association of a large fund of useful information, in the arrangement of the materials, and judicious connexion of their parts; therefore, a happy choice in selection, a judicious arrangement, and a proper connexion of the parts, appear to be desirable in a work of the nature of this which we have now brought to a conclusion. Hoping our own labours may not be found deficient in some of these, at least, we conclude with a quotation from a favourite author: "For we are but of yesterday, and know nothing: because our days on earth are but a shadow." *Job*, viii. 9.

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